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Contents

[III - USSR - 21o S&T]

ACADEMICIAN MARCHUK ON USSR PARTICIPATION IN S&T COOPERATION WITH CEMA

Tashkent EKONOMIKA I ZHIZN' in Russian No 12, Dec 81 pp 34-36

[Article by Academician Guriy Marchuk, deputy chairman of the USSR Council of Ministers, chairman of the USSR State Committee on Science and Technology: "USSR Participation in Scientific-Technical Cooperation of the CEMA Member Countries in Light of the Decisions of the 26th CPSU Congress"]

[Text] The Soviet people, the fraternal nations of socialist countries, and the entire progressive world followed with enormous interest the work of the 26th CPSU Congress. The congress summarized the activity of the party and people in the period following the 25th CPSU Congress and outlined the basic directions for the economic and social development of the USSR for 1981-1985 and for the period to 1990. The chief task of the 11th Five-Year Plan was formulated. It "is to guarantee a further growth in the welfare of the Soviet people based on a stable and progressive development of the national economy, acceleration of scientific and technical progress and transfer of the economy to an intensive path of development, more efficient use of the country's production potential, all possible conservation of all types of resources, and improvement in work quality." The report of Comrade L. I. Brezhnev stressed that "the conditions in which the national economy will develop in the 1980's make acceleration of scientific and technical progress even more urgent."

I will only speak about the key problems in scientific and technical progress. Among them we should primarily isolate the fuel and energy problem. Two of the important conditions for the development of of today's power engineering, as well as the entire national economy are to possess sufficient energy resources, and to use them wisely and economically. It is common knowledge that the rates of development of power engineering define the rates of development of the economy.

The need to improve the structure of the fuel and energy balance, to reduce the percentage of oil as fuel, replace it with gas and coal, and develop more rapidly nuclear energy, including the fast-neutron reactors which are capable of breeding nuclear fuel is now becoming more urgent. In addition, it is necessary to continue the search for basically new energy sources, including the creation of the fundamentals of thermonuclear energy.

The most important problem is to use secondary fuel and energy resources. Our country annually consumes about 2 billion T of conventional fuel. In this case almost 350 million Gcal of secondary energy resources are formed. Their involvement in production is a large factor in the reliable supply of fuel and energy to the national economy.

Machine construction is just as an important key problem of scientific and technical progress. It is called the key sector of the economy by right. To successfully develop machine construction means to increase the unit output of equipment and units, create new machines and production lines and improve the quality of metallurgical and chemical products, in agricultural and in construction, and in the manufacture of consumer products.

The 26th CPSU Congress also indicated the need to mechanize and automate labor-intensive processes, and primarily in those sectors where a lot of workers are still engaged in manual labor, underground work and in conditions hazardous to their health.

The development of a powerful multisector industry has reached such a level today that mechanization, electrification and cybernetization have become possible not in individual technical operations, but in the entire technological process of production from the beginning to the end, i.e., to the output and even the packing of the final product without direct participation of human hands.

It is known that metal is the foundation for modern industry. Technical progress altogether is unthinkable without it. Our country produces a lot of metal, but also consumes a lot of it, tirelessly developing industry, transport and construction. There is not enough metal. In order to solve this problem, we have to improve metallurgical production, develop basically new production processes. Powder metallurgy is a classic example of the most promising technology. Its methods eliminate such traditional processes as melting and casting and do without machining.

Every thousand tons of powder metallurgy items yields over R 165 million of saving, conserves 2,500 T of rolled products, not to mention that the parts are given properties not attainable by other methods. The strength of a tool made of powder fast-cutting steel, for example, is increased 5-6-fold.

Anticorrosion coatings of metals is an urgent task of machine construction. A lot of scientific research work will be done in this area in the 11th Five-Year Plan.

One of the central key problems of scientific and technical progress not only for this five-year plan, but for the next 50 years is automation of both individual elements of the work process, and the entire production cycle. To create conditions in which each Soviet person could work better and with more results is one of the main tasks that we have set for ourselves.

I have only named some of the large problems that we have to solve in the target comprehensive programs of the 11th Five-Year Plan, some of the global tasks of science and technology which define the social and economic progress of our country.

The Soviet Union, like other socialist countries, in fulfilling this enormous work, uses the advantages of international socialist division of labor and makes a contribution to the further development and deepening of socialist economic integration.

The Accountability Report of the CPSU Central Committee to the 26th Party Congress noted that the "CPSU and other fraternal parties are adopting a course to turn the two imminent five-year plans into a period of intensive production and scientific-technical cooperation of the countries of socialism."

Up to one-third of the world's scientific and technical potential is concentrated in the member countries of the CEMA. Over 10,000 scientific research and planning-design organizations and higher educational institutions of these countries annually complete a lot of work, making a significant contribution to the development of scientific and technical progress. The number of results on the level of inventions alone reaches almost 100,000 per year according to the patents and certificates of authorship issued in the CEMA member countries.

A scientific and production base has been set up for development and fabrication of computer equipment. Twelve models of word processors of the unified computer system, four models of computer calculators and over 300 peripheral devices of these systems have passed international tests and were in production by 1981. Development of over 200 packets of applied programs for the ACS [automated control system] for industrial enterprises, production processes, as well as for the creation of systems for automation of planning, design and technological operations has been completed.

A number of most important practical results have been obtained in space research. Joint efforts have created technical means of remote study of the earth. A number of devices have been developed on the level of the best world models for multispectral photography, including devices for interpreting photographs. The countries participating in the "Intercosmos" program employ the methods of remote study of their territories for the development of the national economy.

Joint work done in the field of environmental protection and efficient use of natural resources has borne a perceptible economic effect. For example, efficient technologies have been created for open pit and underground mining which guarantee high technical and economic indicators for ore and coal extraction, as well as efficient use of the depths. The technology of intensive biological purification of water with a high content of nitrogen and organic components has been introduced at a number of enterprises of the nitrogen industry with annual economic effect of almost R 5 million.

In addition to expanding and deepening multilateral scientific and technical cooperation, the Soviet scientists and specialists creatively interact with their colleagues from the fraternal countries on a bilateral basis.

Within the framework of Soviet-Bulgarian cooperation, problems are worked out for the production of computer equipment, creation of machine tools with digital program control (DPC), equipment for lifting-transport, loading-unloading and warehouse operations.

The Soviet and Hungarian scientists and specialists are making joint research to create new models of highly productive machine tools. In particular, a new chucking automatic turret lathe "Sovimag-630" has been designed with DPC for the fabrication of complicated parts under conditions of series and large-series production. The output of this machine is higher than the currentt currently employed 3-4-fold. Manufacture of mills has been set up in the Hungarian People's Republic on a cooperative basis with the USSR. This will allow them to stop importing from the capitalist countries.

Cooperation with the Soviet Union will help the Socialist Republic of Vietnam to accelerate the development of science and technology and train their national cadres.

Economical direct current pulse generators have been developed together with the scientists and specialists of the GDR. Organizations of the USSR Ministry of Construction Materials Industry and the GDR Ministry of Construction have formulated technology and created equipment for production of large-sized items made of dense silicate concrete on automated conveyer belts.

Scientific and technical cooperation between the USSR and the Republic of Cuba includes joint studies and developments, exchange of scientific and technical documents and information, and training of skilled cadres.

The scientists of our country and the Mongolian People's Republic have formulated forecasts up to the years 1990 and 2000 for the development of the coal industry, power engineering, construction materials industry, etc.

Joint work is successfully being developed between the Soviet Union and the Polish People's Republic in machine construction, chemical industry, metallurgy and ship building, and between the Soviet Union and the Socialist Republic of Romania in oil extraction, power engineering, machine construction, chemistry, and production of consumer goods.

The Soviet specialists from the ENIMS [Experimental Scientific Research Institute of Machine Tools] and the colleagues from the Czechoslovakian Scientific Research Institute of the Metal-working Industry have made automatic manipulators with programmed control (industrial robots) to service the machine tools. A lot of work is being done on a mutually advantageous basis with Yugoslavia.

These are only a few examples of the very broad front of our joint work.

Cooperation of the CEMA member countries in the field of science and technology is constantly being deepened and improved. The comprehensive program has become an important stage in its development. The DTsPS [expansion unknown] which define the coordinate strategy of the joint work of the CEMA countries to 1990 are a further evolution and individualizing of the comprehensive program.

The countries of socialist cooperation are holding mutual consultations on questions of scientific and technical policy. Among the results are the Basic Directions for Scientific and Technical Cooperation of the CEMA Member

Countries and the Technical and Economic Consequences Expected on this Basis for 1976-1980 and to 1990 developed by the CEMA Committee on Scientific and Technical Cooperation. Thirteen major problems of science and technology were selected for the Coordinated Plan for Multilateral Integration Measures for 1981-1985 in the field of energy, machine construction, chemistry and oil refining, and agriculture.

All of this indicates that scientific and technical cooperation of the CEMA countries has successfully developed and has made a significant contribution to strengthening their economy. However, the higher requirements that are now made for the results of this cooperation, as well as a number of not fully resolved problems of its organization and control allow us to state that the efficiency of joint work does not yet completely meet the objective requirements and the available potentialities.

Under modern conditions, "life itself raises the task," Comrade L. I. Brezhnev noted in the Accountability Report of the CPSU Central Committee to the 26th Party Congress, "of supplementing the coordination of plans with the coordination of economic policy as a whole. Such questions are on the agenda as convergence of the structures of economic mechanisms, further development of direct ties between the ministries, associations and enterprises participating in the cooperation, creation of joint firms, and other forms of uniting our efforst and resources are possible."

Thus, a clear line has been plotted on which we need to improve our cooperation, make fuller use of the reserves for improving its efficiency, and develop progressive forms of interaction.

What measures can and should be adopted even today, right now for this purpose?

It is expedient to analyze the subject matter selected during the coordination of plans for development of science and technology for 1981-1985 so that it can be oriented to a greater degree on solving national economic tasks of the current five-year plan. They should be divided into three groups depending on the scales and periods for realization of the programs.

The first includes scientific and technical problems whose solution already in the current five-year plan will guarantee the development and production of advanced machines, equipment, materials and the mastery of new production processes. The second includes those problems which will create the necessary scientific and technical reserve. It will guarantee the introduction of results of cooperation in the next five-year plan because the basic scientific research and planning-design work, as well as the experimental-industrial verification must be completed in this five-year plan. The third group includes problems of a fundamental and search nature.

As the practice of cooperation has shown, the most significant results and the effect from their introduction into the national economies of the CEMA member countries are achieved precisely where there is successful close cooperation of the scientific research and planning-design organizations with the future manufacturers and consumers of products.

But there are still many reserves precisely in the setting up of this cooperation. Whereas in the framework of the sector cooperation and its corresponding agencies, effective interaction of scientific-technical and production links has been successfully set up, this interaction on intersector problems still requires complicated multistage agreements. A comprehensive approach to planning will permit closer correlation of the joint scientific research work and measures on specialization and cooperation of production.

The time has come to examine the question of creating joint scientific research, planning-design organizations, and scientific production associations. They must ensure development of new equipment and an entire complex of measures for its specialized cooperative production.

It is also necessary to significantly expand the system of contracts in order to regulate the commitments and increase the responsibility of the producer organizations in cooperation of research and developments based on division of labor.

It is our opinion that the necessary conditions and prerequisites have matured for a broad transition to comprehensive (general) agreements which encompass the entire cycle "science-production-marketing." These agreements must bear a continuously active nature. This can be attained by expanding the time horizon, having indicated in them measures for the long-term future. It is lawful to raise the question of joint introduction into production of results obtained on lines of cooperation.

It is necessary to focus more attention on questions of standardization. It is expedient to formulate intersector programs for comprehensive standardization, having designated in them the coordinated requirements for raw material, materials, set-forming items and finished products, and at the same time significantly increasing the requirements for the quality of the products manufactured by the CEMA member countries. One should also introduce into practice of cooperation of the CEMA member countries the certification of mutually supplied products.

This in brief is what needs to be done today. A glance "at tomorrow" will specify other tasks. In order to significantly improve the role of scientific and technical cooperation in intensifying social production, the CEMA member countries are faced with conducting a coordinated scientific and technical policy, in particular:

concentrating attention on the most important priority problems, including those following from the coordinate plan for multilateral integrated measures for 1981-1985, as well as long-term target programs of cooperation; elimination of multiple topics and parallelism in the joint research and development;

stipulating for each joint development technical and economic substantiations which would contain the basic parameters as compared to other world analogs, define the necessary scientific research and experimental design work, including suggestions for division of labor, approximate needs, considerations for

specialized and cooperative production of items to be made, and evaluation of the expected economic effect;

improving the planning-economic mechanism for scientific and technical cooperation, including generation of forms and methods for taking into consideration the economic interests of the participating countries, and increasing the economic interest and responsibility of the partners;

converging the structures of the economic mechanisms of the countries in order to rapidly and efficiently realize the achievements of science and technology and ensure their mass introduction into production;

mutually study the experience of planning and control of scientific and technical development.

Realization of the listed measures makes it possible to improve and deepen the scientific and technical cooperation of the CEMA member countries, and improve its role in the social and economic progress of our countries.

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CSO: 1814/53

CEMA MUTUAL CONSULTATIONS HELD ON ECONOMIC AND S&T POLICY

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian
No 1, Jan-Feb 82 pp 30-32

[Article by Miklosh Kasich, CEMA Secretariat: "Mutual Consultations Within CEMA Framework on Basic Questions of Economic and Scientific-Technical Policy"]

[Text] According to the comprehensive program for further deepening and improvement and cooperation and development of socialist economic integration among the CEMA member countries, mutual consultations within the CEMA agencies on basic questions of economic and scientific-technical policy have been called on to promote the creation of more favorable conditions to deepen the separation of labor, gradual development and realization of trends for coordinated strategy of development of the socialist economic integration in order to accelerate the development of the CEMA member countries economies.

The comprehensive program also defined the main content of the mutual consultations:

Basic trends and instruments for economic and scientific-technical policies;

Basic trends for economic development;

Most important trends for scientific and technical progress, use of the achievements of science and technology, coordination, cooperation and mutual conducting of scientific-technical research;

Questions of improving the systems of planning and control of the national economy;

Questions of improving the economic and scientific-technical cooperation of the CEMA member countries.

In the first years of realization of the comprehensive program, the CEMA committee on cooperation in the area of planning activity examined during consultations the basic trends for economic development and cooperation among the CEMA member countries for the long term future and five-year periods, gradual convergence and balancing of the levels of their economy; problems of fuel and energy sector, development of a raw material base, including ferrous and

nonferrous metallurgy, and the chemical industry; questions of cooperation in the area of capital investments and development of agriculture in the CEMA member countries.

The consultations conducted before work to compile national economic plans for 1976-1980 to a certain measure promoted the determination in the CEMA member countries of the basic directions for economic development. Consultations on fuel and energy problems permitted the countries to obtain information to take supplementary measures for the development of an in-house fuel base, especially through types of solid fuel. With regard for the recommendations of mutual consultations in relation to a raw material base for the ferrous and nonferrous metallurgy, as well as the development of petrochemistry in the countries, additional resources were allocated for the maximum use of in-house raw material base, conservation of raw material, improvement in the technical level of the sectors of the extracting and refining industries.

Mutual consultations fostered more successful coordination of the national economic plans of the CEMA member countries for 1976-1980. In order to solve the set problems within the framework of coordination of five-year plans, specific agreements were reached which were partially reflected in the coordinated plan of multilateral integration measures of the CEMA member countries for 1976-1980. The considerations and suggestions made during the consultations were also taken into consideration in preparation of draft long-term target programs for cooperation.

These consultations, however, were only held in certain agencies of the council. At the 32nd meeting of the CEMA session (1978), it was noted that mutual consultations on the basic questions of economic policy have still not become a system which would permit coordination of the most urgent problems and long-term trends in multilateral and bilateral cooperation. In this respect, the 32nd meeting of the CEMA session adopted the document "Basic Directions for Further Improvement in the Organization of Multilateral Cooperation of the CEMA Member Countries and Activities of the Council," which defines specific tasks for the CEMA agencies in this area:

Expansion of consultations on problems of economic policy, including basic directions for cooperation for a five-year period;

Depending on the nature and scale of questions, conducting of consultations at meetings of the session and executive committee of the council, CEMA committees for cooperation in the area of planning activity and for scientific and technical cooperation, and for questions of sector development in the appropriate permanent commissions so that the CEMA member countries could upon examining them take into consideration the results of the consultations when they formulate the basic directions for development of the national economies and other economic measures;

Including consultations in the work plans of the appropriate CEMA agencies.

Work to hold mutual consultations has been activated in recent years to execute this decree. They are currently held regularly in the majority of CEMA

agencies, and with regard for the list of topics for discussion at the mutual consultation in the appropriate permanent commission approved at the 97th meeting of the executive committee.

Since 1980, mutual consultations have been held at the meetings of the CEMA executive committee. Within the frameworks of the consultations organized at the 93rd meeting of the executive committee, information was exchanged regarding the course of socialist and communist construction in the CEMA countries, the results of fulfillment of national economic plans for 1976-1980. Urgent questions of economic cooperation and basic trends of its development for 1981-1985 were examined. Representatives of the countries made a number of suggestions for further expansion and deepening of economic cooperation and the most important questions of economic and scientific-technical policy of the CEMA member countries which were the basis for a compilation and then approval at the next meeting of a program for further mutual consultations within the framework of the executive committee.

According to this program, the consultations held at the 97th meeting of the executive committee for improvement in the process of development and deepening of specialization and cooperation of production greatly promoted the fulfillment of the decisions adopted at the 34th meeting of the CEMA session and determination of specific tasks of the CEMA agencies in this area. It was indicated that it was necessary to have comprehensive cooperation at all stages of scientific research, technical development, mastery and organization of production of a number of important machines, equipment and other items of high technical level on principles of specialization and cooperation, as well as strengthening of work for unification and standardization of specialized and cooperated products, especially assemblies, parts and components. Additional measures were outlined for multilateral cooperation by the interested countries of technical and economic policy for the development of basic interrelated sectors, so that further work to expand and deepen international specialization and cooperation of industries in priority areas would be fostered.

At the 98th meeting of the executive committee, the representatives of the countries held a mutual consultation on questions of improving cooperation in the area of science and technology. During this meeting they stressed the importance of the interested countries conducting a coordinated scientific and technical policy, strengthening interrelationships of scientific and technical production-economic operation of the CEMA member countries, strengthening a comprehensive approach in planning stipulating research, technical development, the introduction into production of new products and organization of mutual shipments. Attention was drawn to the need to concentrate forces on solving the most important questions of scientific and technical cooperation emerging from measures included in the DTsPS [expansion unknown], primarily on a contract basis. The expediency was noted of concentrating attention primarily on creating complexes of machines and equipment, developing leading technology which guarantee a significant growth in efficiency of social production, as well as implementation of measures for efficient use of raw material and energy carriers, for a further significant improvement in the technical level and quality of mutually supplied products.

The main conclusions of this consultation are reflected in the report presented by the CEMA committee on scientific and technical cooperation to the 35th meeting of the CEMA session regarding further improvement in cooperation in the area of science and technology towards accelerated creation and introduction into production of the leading technologies, equipment and new materials.

Of great importance for the preparation of coordination of five-year national economic plans was the consultation within the CEMA committee for cooperation in the area of planning activity. The leaders of the sections of the centralized planning agencies of the CEMA member countries exchange information about the general results and problems of social-economic development in their countries during 1976-1980 and the basic tasks of their economic policy in the area of developing the national economy for 1981-1985, and the expected influence of this policy on the sector structure of the national economy. The representatives of the countries characterize the possible rates of growth in the national income, technical progress, measures to meet the demands of the national economy for energy, fuel, raw materials and basic materials, as well as to improve the material and cultural level of the life of the population.

At the 57th session of the CEMA permanent commission on cooperation in the area of electricity, the heads of the delegations exchanged opinions regarding the most important and urgent problems in the area of power engineering, outlined the methods, stages and schedules for solving the questions raised. During the consultation, a general coordinated approach was reached regarding the outlook for development of electricity in the CEMA member countries and agreement on further discussion of questions by the commission, its working agencies and the CEMA Secretariat.

As a result of the mutual consultation held at the 34th session of the CEMA permanent commission on cooperation in the area of the food industry, a conclusion was drawn regarding the need to improve cooperation for accelerated introduction of new technology and equipment, provision of the sectors of the food industry with high quality raw materials, materials, highly productive equipment and modern packaging materials, as well as the efficient use of raw material and material resources.

Consultations and exchange of information are regularly held in the CEMA permanent commission for cooperation in the area of civil aviation. These concern agreements concluded between the countries regarding air passages and opening of new international airlines, the experience of preparing the signing of new agreements with third countries.

At the 37th session of the CEMA permanent commission on cooperation in the area of statistics, mutual consultation was held on questions of statistical accounting, accountability and the use of a number of new indicators associated with improving planning and strengthening the effect of the economic mechanism on improved efficiency of production and quality of work, and on questions of territorial statistics.

What has been said indicates that mutual consultations concern a broad circle of problems and reveal possible areas of expansion and deepening of cooperation,

by concentrating attention on solving questions that arise during the discussion. According to the results of the conducted consultations, in the majority of cases specific suggestions are made with indication of possible ways to realize them. The working organs are entrusted with preparing additional documents. Often decisions are made about including the appropriate themes in the work plan of the agencies for the next period.

The importance of mutual consultations was again stressed at the 35th meeting of the CEMA session (1981). For purposes of further improvement in multilateral economic cooperation, a recommendation was made that the CEMA member countries widely use in the operation of the CEMA agencies mutual consultations on basic questions of economic and scientific-technical policy, including questions of further development in the national economy of maximum conservation of material and energy resources, acceleration of the process of structural changes in the economy, key problems of cooperation in the areas of material production, in the field of science and technology, foreign trade, currency-financial relations, and problems of communication with third countries. Guided by the statutes of a comprehensive program, it was recommended that forms of summarizing these consultations be improved.

The Secretariat of the council, in fulfilling the instruction of the executive committee, analyzed the experience of mutual consultations available in the CEMA agency for basic questions of economic and scientific-technical policy and development of suggestions for further improvement in the forms of work. The appropriate materials must be presented to the executive committee in the first quarter of 1982.

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FORECASTING DEVELOPMENT OF TECHNOLOGY

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA EKONOMICHESKAYA in Russian No 5, Sep-Oct 81 pp 60-73

[Article by A. I. Smirnov: "On the Question of Forecasting the Development of Technology"]

[Text] This work undertakes an attempt to forecast the development of technology, and a concept of technology controllability has been formulated. It examines the development of one of the technologies that lie at the foundation of material culture -- the technology of forming. The essence of interaction between the basic subsystems -- energy and information -- of any machine is formulated. A unified classification of machines is constructed.

In the present work, technology is understood as a system that includes both methods and equipment used by man to satisfy his material needs. According to the degree of remoteness from the end user -- man -- all technologies can be divided into primary -- extractive -- and secondary -- processing.

The product of extractive technologies is raw material necessary for the processing technologies. The types of raw material are rather limited and the number grows slowly even during the period of the scientific-technical revolution. At the present time on Earth, there are a total of 1800 to 2000 types of minerals,[1] and no more than 20 items are added yearly to this list. On this basis, we consider that it is simpler to forecast extractive technologies than processing technologies. The material needs of the population of developed countries (and it is they who determine progress in technology) grow not as much quantitatively as qualitatively. Accordingly, the numbers of product types of processing technologies is growing and changing. A number of previously unknown technologies have appeared before our eyes: nuclear, aerospace, and so forth.

To expand this, we divide processing technologies into two groups: technologies that change the microstructure of matter (chemistry, metallurgy, food industry, agriculture, etc.) and technologies that provide for transformation of the macrostructure of matter (processing of metals and construction materials, machine building, construction, etc.). The technologies of the latter group are united in that, to achieve a given user effect, it is necessary to give a defined form to a manufactured item. We call these formative technologies. Among them, of greatest

interest are technologies of primary formation that provide for producing /components/[in italics] of a given form, which can be utilized independently or aggregated into a /manufactured item/[in italics].

The theoretical task posed in this paper is to distinguish the basic regularities that control the development of technologies. It has been done on the basis of materials of the technology of primary forming as one of the most representative. The applied aim of the paper was to forecast the chief trends in the development of forming technology over the long term and to formulate, on this basis, scientific-research and experimental-design topics.

At the beginning, analysis was done on domestic and foreign periodicals on the chosen topic during the period 1970 to 1980 (about 7000 units of 50 titles) and also on bibliographic references found -- several hundred publications issued between 1945 and 1979.

From this information mass a list was made consisting of 10^3 items, each of which included a forecast of some event in forming technology. Analysis of this primary list showed that, with respect to almost any event, there are alternative or mutually exclusive judgments. To chart the controlling decisions, it was necessary to arrange the list according to the significance of the elements contained in it, to discard less important events, and also to investigate substantive contradictions and to select and compare alternatives.

Various quantitative economic methods are usually applied for the comparison of the effectiveness of alternatives. However, in the present situation, it was necessary to compare subjects that yielded poorly to such evaluations: ideas expressed in mock-ups or experimental models or not materially expressed at all, development concepts, and so forth. Therefore, to explain advantageous lines of development or to compare alternatives, a qualitative method, which we called "ontological forecasting" was used.

The sequence of actions in putting together an ontological forecast is as follows:

1. The finding of the more general regularities, depending on the current situation, that control the development of the subject of forecasting. This stage essentially requires the creation of the bases of a general theory of the subject based on achievements and laws of fundamental sciences, that is, the ontological theory. We emphasize the word "ontological," since virtually all applied disciplines over 50 years old have been based on a phenomenological approach.

2. The revealing of indicators that quantitatively characterize the research subject. These indicators must reflect the general laws of nature, invariant relative to the current situation and used in the research subject to achieve the established goals. From this point of view, we consider it incorrect to apply value indicators in long-term forecasting. The indicators selected should also characterize the correlation among the goals for the sake of which the examined subject is being created, and the funds spent in its creation, that is, they should be indicators of effectiveness.

3. The calculation of the absolute level achieved in the development of the subject at the time of the forecast, that is, the quantitative significance of the indicators.

4. The determination of the prospects for the development of the subject. It is done on the basis of the hypothesis that the development of an indicator of effectiveness in time takes place along a "saturation" curve, for example, logistical. In the simplest cases, the level of "saturation" may be established on the basis of the general laws of physics, for example, the law of conservation. Further determination is made of the level of development of the subject relative to the level of "saturation," that is, the coefficient of utilization of maximum natural capabilities in the actually existing subject. If this coefficient is near unity, further improvement of the subject that utilizes the given natural mechanism is obviously ineffective and new ways need to be searched for to achieve the given effect.

For sufficiently complicated subjects, most often it is not possible theoretically to determine the level of "saturation." In this case, it is necessary to track the change in the given indicator with time. If it is intense enough, one can propose that the selected development trend has not exhausted its natural capacities and it should be kept. If the indicator being investigated does not change over a sufficiently long time interval, it is probable that the capacities of a given principle have not been exhausted and should be transferred for utilization under a new principle, for the determination of which the general theory of the subject, constructed in the first stage of forecasting, is used.

The purpose of forming technology consists of creating solids of various predetermined forms and dimensions. To achieve this, resources -- labor and raw material -- are used.

The limitation of human resources and the requirement for increasing labor productivity forces the choice, from among all possible areas of development of forming technology of only those that are intensive relative to labor expenditure. The latter should be taken into consideration both in creating and in utilizing forming equipment. In a long-term forecast, it is necessary, in our view, above all, to determine the areas that lead to fuller accomplishment of established tasks without consideration of the labor content of creating the corresponding equipment. Only after this does it make sense to pose the task of realizing the chosen area with the designated labor expenditures.

Intensive development relative to raw material resources requires a reduction in the specific materials content of forming equipment (as a design problem, it will be examined later), reduction in wastes of material during forming, and priority development of reduced waste methods of forming.

The degree of completeness and waste reduction in various methods of forming is reflected in the German standard DIN8580, which separates all methods according to the most general principle, the topological principle -- coherence. In accord with this classification, the most widespread primary forming of items from metal at

the present time -- cutting (45 to 60% of the total labor content in machine manufacture) -- is the only method that, in principle, is inherently wasteful of materials. Consequently, this shortcoming in the cutting method should be compensated for by some no less principled merit that has given this method a dominating position for at least a half century, merit that to a significant degree is invariant relative to the current situation.

To determine the invariant, let us examine the most general systemic technology model. Let us imagine it in the form of a black box, where the input consists of materials, energy, and information, and the output consists of the required result. It is clear that this model satisfies the requirement for completeness, and a simpler model simply does not exist.

In the general technology model it is necessary to select the features that are specific for forming technology. In such a general approach, the specifics of each technology can consist of just the various relationships between the output and three basic input flows.

Various Classifications of Forming Technology

1. According to Topological Characteristics of the Results of the Process (DIN8580)

	Those that create relationships	Those that retain relationships	Those that break relationships	Those that increase the number of relationships
Examples:	casting	forming	cutting	welding

2. According to the Physical Process Being Used (Generally Accepted Classification Practice)

Casting	Pressure Treatment	Cutting	Electrophysical, Electromechanical and Other Methods

3. According to Cybernetic Characteristics (The Proposed Classification)

Controlled	Noncontrolled
Mechanical Processing	Casting

Pressure Treatment

Electrophysical and Chemical Methods

Up to now, in examining forming technology, the basic attention among all input flows has been allotted to the materials flow. Its analysis has already been put at the base of the already mentioned technology classification according to DIN8580, according to which, incidentally, cutting is the least preferable means of forming since it unavoidably involves the presence of wastes. According to the classification proposed by Academician I. I. Artobolevskiy, forming machines belong to the category of working machines, the specific feature of which is the "transformation of materials."

In general, although attempts are also known of selecting energy flow as an indication of forming technology,[2] at present the idea is generally accepted that it can be characterized more fully by examining the materials flow.

In our view, the materials flow better characterizes transportation and extraction technologies, and energy flow, the power technologies. However unusual it may seem, we consider information flow to be the most specific for forming technologies.

To prove this thesis, let us turn to the forming technology model. The finished item -- the result achieved by applying forming technology -- in general differs from the sum of the input flows of mass (part of the materials, for example, have become waste), energies (for example, internal stresses arise in the manufactured item after treatment), and also in the quantity of geometric information which is contained in it and which is expressed in the changed form of the item.

One can imagine a process of forming in which the mass of stock coincides with the mass of the manufactured item; the amounts of energy contained in the stock and the manufactured item do not differ, but there is always an informational difference. In this lies the sense of the forming process that is being examined in such general categories. Of course, the flows of materials and energy are inseparable components of the forming process, whereby the first reflects the object of the influence and the second, the means of influence. However, the essence of the process consists of the transfer of information to the object (material) with the aid of energy, the same way that the essence of energy technologies consists of the transfer of energy, and transportation and extracting technologies, in the transfer of materials.

Thus, ontologically, the process of forming is defined as a /process of transferring certain a priori information to the stock, as the result of which a manufactured item of a given form is produced/[in italics]. With such an approach, the most characteristic properties of forming technologies are those relating to the transmission of information, that is, the cybernetic properties. The fundamental concept of cybernetics is the notion of feed-back and open and closed systems of control. Let us use these concepts to classify the .arious forming technologies. The technologies that use the open scheme, without feed-back concerning results and without interference in the forming process in order to change the result,we will call /noncontrolled (programmed)/[in italics]. Let us contrast these technologies with those that are /controlled/[in italics] andare brought about according to a closed scheme with feed-back on the current result of the process. Equipment to control forming has been constructed that allows the opportunity to interfere during the course of the process and change its result (in distinction from equipment for noncontrolled forming).

Under this definition, controlled technologies for primary forming include, first of all, for example, processing on metal-cutting machine tools, the majority of

modern electrophysical and electrochemical methods, all types of manual processing, and certain types of pressure processing -- free forging. Fully noncontrolled technologies are represented by casting and three-dimensional punching.

Let us examine how the basic consumer properties of forming technologies change according to whether they belong to the controlled or noncontrolled class.

As noted, forming technology differs by the extremely large number of types of manufactured products, which exceeds by several orders of magnitude the majority of other technologies. At the same time, the number of types of forming equipment is insignificantly small relative to the number of product types. Thus, the total number of types of metal-cutting machine tools includes on the order of 10^3 units; the total number of types for pressure treatment, 10^2; and the lowest number of types of components produced by metal working, 10^9.[3] Therefore, the specific characteristic of forming equipment is its universality, that is, the capability for making a wide spectrum of manufactured items of various forms.

In this connection, in the process of forming, which we treat as a process of information transfer, two stages can be clearly distinguished. In the first, preparatory stage, information on the form of the future manufactured item is transferred to certain intermediate carriers -- equipment, tools, punched tape for numerical program control (NPC), and so forth. In the second stage, information about the manufactured item is transferred to the stock, that is, forming proper takes place.

Relative to these stages, three concepts have evolved that are characterized by consumer properties: common to many technologies, the concepts of productivity and precision (quality) characterize the state of forming proper and the property of flexibility, specifically for forming technology, characterizes the preparational stage.

We have not been able to find a formulation of the "flexibility" concept; however, in all contexts, it includes the same content, which allows using the labor content of the restructuring of technology for manufacturing a new type of manufactured item in the role of flexibility indicator.

Comparison of the times spent on various details by controlled (mechanical processing) and noncontrolled (punching and casting) methods shows that, on the average, the productivity of the noncontrolled methods is higher than the methods of the controlled methods by one or two orders of magnitude. Thus, the methods of modern controlled forming differ not only in increased use of materials, but also in lower productivity in comparison with noncontrolled. This, obviously, can be explained by the fact that noncontrolled forming uses natural processes (for example, the property of the flow material to take the form of the container), the flow rate, which is limited by purely physical reasons. At the same time, with controlled forming, in our view, the limiting factor is the operating speed of the control system, which is limited by the current level of technical development. Each component represents an object in space or a system with distributed parameters, at a time when current control systems are able to operate with only a limited number of parameters. At this stage, forming proper by controlled methods is more labor-consuming than by non-controlled methods (control requires additional expenditures of labor). Therefore, present equipment for

control of forming attempts to use as much as possible pre-programmed elements (for example, the concept of a straight line or plane is put into the guide bearings of the metal-cutting machine tool, and the concept of turning bodies, into the shaft bearings). The property of control is used for the task of mutual distribution of surface elements programmed into the design of the machine tool.

Control of the forming process with feed back according to result (according to the precision of the form of the manufactured item) permits the production of items, in principle, with unlimited precision, at the same time that precision of items produced by noncontrolled methods are, in principle, limited. The limitations come from the general law of causality which, relative to a given case, can be formulated thus: the degree of achievement of a given aim by program methods is determined by the degree of determinancy of the process of achieving this aim.

The forming process consists of producing a manufactured item of a given form and precision, but the degree of determination of this process is determined by fluctuations of the initial and current parameters that affect its result. By fluctuation, we mean the deviations of the parameters, not provided for in the program, from nominal sizes (in this, naturally, changes in parameters introduced on purpose or by direction are not considered controlled). Because of this limitation on the precision of forming, controlled methods significantly exceed noncontrolled methods.

However, there is a great number of manufactured items, the requirements for precision of which permit their production by noncontrolled methods but which, nevertheless, are produced on controlled equipment. This is explained by the much greater /flexibility/[in italics] of controlled technology. It is characteristic of controlled technology that all geometric information on the future item is put in fully during the preparational stage in the form of a strict form-carrier -- stamp or casting form. No additional information on the form of the item can be introduced during the stage of forming proper -- this is not permitted by the design of equipment for noncontrolled forming. The property of control permits not putting in all of the geometric information on the future item at the preparational stage. A significant part of it is introduced directly at the forming stage. For this reason, the amount of labor at the preparational stage is significantly lower for controlled technology than for noncontrolled technology.

Since present production has basically a small-series and series character and a steady trend is being noted toward reduction of series, the labor-saving property of the flexibility of controlled technology has been decisive and has provided it a dominating place among all forming technologies.

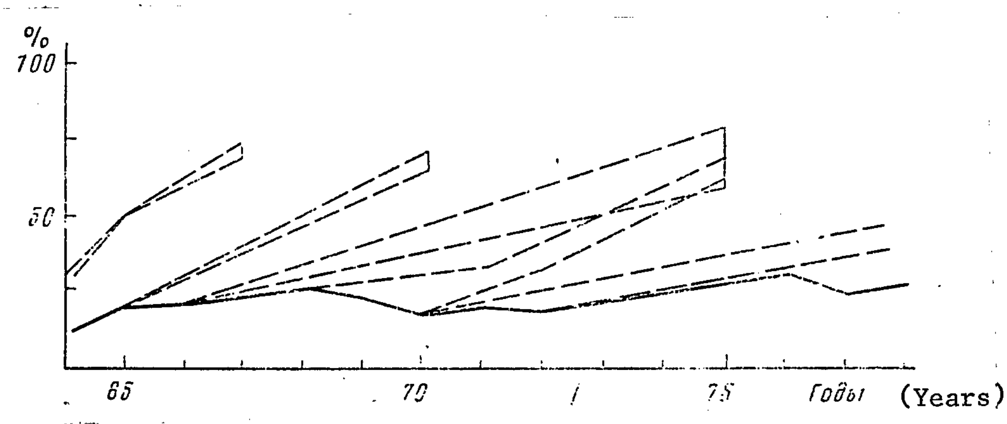
Thus, the fundamental property -- controllability -- has stood out; it determines the qualitative difference of technologies according to basic consumption characteristics: productivity, precision, and flexibility. Also revealed has been the relationship, invariant of the current situation, of the labor content of each stage of the forming process to the controllability of the selected technology. Other conditions being equal, the labor content during the preparational stage for controlled technologies is always less than for noncontrolled technologies.

If the minimum total labor content is taken as a criterion, the best equipment for small-series and series production can be considered to be controlled technology, which is able to carry out the stage of forming proper in a programmed manner, that

is, noncontrolled. It is according to this path also that the evolution of forming technology has taken place. Thus, in primary forming, to replace manual processing (purely controlled technology), there have been potters' wheels and the first lathes, which contained elements of programming (a form was produced with the aid of a given forming rotation), and then there appeared universal metal-cutting machine tools with manual control. A revolutionary jump in this process is unanimously considered to be the creation of machine tools with numerically programmed control (NPC). Since these machine tools are controlled equipment, they provide for a small amount of labor content during the preparational stage and, at the same time, permit forming proper to be done in a completely noncontrolled, programmed, manner.

Machine tools with NPC have been introduced into industry since 1960. Their share of the yearly output of machine-tool building in the United States and Japan in 1980, for example, was 30 percent (in value). The total expenditures for introducing NPC machine tools has already reached billions. In the last decade, publications devoted to NPC machine tools have been a large part of the total volume of special literature. Reports have become common to the effect that the productivity of these machine tools exceeds the productivity of manually controlled machine tools by a factor of from 5 to 8; rapidly expanding application is predicted for them.

In the present work, forecasts of the development of NPC machine-tool output in the United States made during the period 1960 to 1972, were contrasted with the actual output of these machine tools, in percentages of the value of the annual volume (see drawing). As seen on the graph, the actual rates of introduction of NPC machine tools (solid line) not only substantially lagged the estimated rates being forecast (the broken lines) based on suppositions of their effectiveness, but they also stabilized and reached saturation in the middle 1960's. In this connection, the share of NPC machine tools (in natural expression) in the total stock of machine tool equipment in the United States did not exceed 2 percent in 1978.



Forecasts (Broken Lines; the Year of the Publication of the Forecasts Is Shown as the Beginning) and Actual Output (Solid Line) of NPC Machine Tools in the United States in Percentages of Value of All Manufactured Machine Tools.

The fact of the stabilization of the output of NPC machine tools forces the assumption that the principles laid into present NPC were unexpectedly quickly exhausted, and the further development of such equipment in this area is not advantageous and requires new solutions.

The ontological model of forming technology constructed in this work permits distinguishing the necessary measures.

As has already been shown, the concept of current NPC responds to the principle of minimum total labor content of both stages of the forming process (with consideration for the revealed dependencies of labor content of each of them on the degree of technology controllability).

However, in this concept, the limitation in principle, inherent in programmed processes, is not taken into consideration at all -- the limitation in the precision of the results. It would seem that it does not have a direct effect on the labor content of the forming process. But the process simply must reach the established aim -- the production of a given form with given precision and, with the use of programmed methods, additional labor has to be expended to raise the degree of determinancy of the process parameters and to fight against fluctuations in the parameters of the stock, the equipment, and the environment. Such labor can and more often does turn out to be much more substantial than the labor necessary for controlling the process. This is explained by the fact that the design of present NPC machine tools already basically has performance mechanisms for controlling the precision of the form of the manufactured product; just the means for producing information on the current result of the process is not enough. And, on the other hand, working on the controlled equipment without control of precision is underexploitation or nullification of the basic property already put into this equipment.

Comparison of the following facts are the basis for the conclusion that the chief reason for the slower introduction of NPC is the absence of control over precision. It is evident that the greater the series of production, the more perfected is the technology (in our terms, the greater the degree of determinancy of the process). Thus, in mass and large series machine building production, the quality of stock is much more stable (allowances and hardness), the instrumentation is better worked out, and so forth. And, despite the large degree of process determinancy, the automatic production lines of these plants are broadly equipped with instruments for operating control (that is, devices to control the precision of forming, in our terminology). For example, at the Volga Automotive Plant, over 75 percent of the grinding equipment of the "Motor" and "Chassis" shops were equipped with them.[5] In small series and series machine-building production, the degree of determinancy of which is significantly less, not one of the automatic forming machines -- NPC machine tools -- were equipped with an operating control device. Instead of this, in the introduction of NPC machine tools, the same means are applied for increasing process determinancy that are applied in mass production: great efforts are expended to increase the hardness of the machine tool, the preliminary dimensional adjustment of tools, and so forth. With respect to small batches of parts, these efforts do not pay for themselves.

Thus, to further lower the labor content of forming in series or small-series production, it is necessary to create means for producing information on the current geometric parameters of the manufactured item. Preliminary analysis shows that this

task can hardly be accomplished by the efforts of the machine-tool building sector by itself, which is responsible for the output of NPC equipment. It would be advisable to accomplish it within the framework of a complex program under the State Committee for Science and Technology.

Using the produced general laws that relate labor content to the degree of controllability of technology, for example, to the technology of primary forming of items from metal and wood, it can be said that until a method is created that is as good as mechanical processing in the degree of controllability and exceeds it in the coefficient of material use, mechanical processing will dominate. Even after the invention of this method, during its introduction, there will be a need to make maximum use of the "legacy" of its predecessor -- mechanical processing (particularly, this effect clearly appears in the development of machine tools for electrophysical methods of processing). To substantially change the structure of the stock of forming equipment will require a decade -- these are the objective laws of economics. In this connection, the first-priority task in forecasting the development of forming technology is the determination of such means for improving the design of present control equipment that would develop their most important and invariant property -- controllability, irrespective of the physical method being used to change the form of the stock. Then, the hypothetical "successor" to present-day physical mechanisms for forming can replace them without affecting the basic design of the machines, that is, with minimum expenditure.

Further, the general aspects of the development of controlled equipment are investigated with the specific example of metal-cutting machine tools.

Let us examine first the problem of lowering the material content of machine tools. As an indicator of effectiveness, let us take the relationship of the mass of the machine tool to the basic characteristic of effect -- productivity.

According to V. I. Dikushin, the most general of the indicators of machine-tool productivity known at the present time is absolute productivity, which is characterized by the power used in forming.

Out of consideration for convenience in processing the data, the significance of the indicator, inverse specific materials content (which we called energy intensity in the design of metal-cutting machine tools) was calculated for 2020 machine-tool models entering the inventory of the 10th Five-Year Plan and also for 89 foreign models presented at the EMO-2 exhibit (Hannover, 1977). For 95 percent of the designated sample of machine tools, the magnitude of energy intensity lay within the limits of 1 to 5 W/kg, and the average was 2.3 W/kg.

The next stage was to determine prospects for improving the energy intensity parameter. Since to expose theoretically the maximum level did not seem possible, the dynamics of this parameter during the period 1950 to 1978 were observed. Insofar as the boundaries of change in the energy intensity parameter were different for machine tools of different technological groups, tentative categories according to technological groups polarized and, within the technological group, according to models with similar basic parameters brought into the machine-tool industry. In a 11, there were 42 tentative categories, including 182 different models and modifications of metal-cutting machine tools of the basic groups -- lathe, milling, boring, and

polishing. Among the most widely used machine tools -- lathes -- there were 23 categories, among the horizontal-boring machine tools, 7 categories, among the polishing-wheel machine tools, 6 categories, and among the milling machine tools, 6 categories.

In 16 categories, a decline was noted in the energy intensity parameter of up to 120 percent during the period examined; in 14 categories, it remained practically unchanged; and in just 12 categories, it rose from 5 to 33 percent. In the whole machine-tool sample, the average weighted change in the energy intensity parameter was 11.5 percent, and the most notable decline was observed at the end of the 1960's.

Insofar as energy intensity is a quantity, the inverse specific materials content, it means that, during the period examined -- almost 30 years -- the specific materials content of machine tools not only did not go down, but even increased on the average by 11 percent, despite the fact that a great deal of attention was always given to the task of reducing it, especially in recent times.

The fact of stability and even certain decline with time of the parameter of energy intensity of machine tools was subsequently reaffirmed by numerous tests, in which analysis was made of the dynamics with time of averages of values for this parameter according to inventories, averages according to exhibits in various years, and so forth (in all, 907 machine-tool models were examined).

In combination with the data of B. L. Boguslavskiy,[6] which noted the growth in the energy intensity of machine tools created from 1936 to 1950, the results we obtained form a right-handed asymptotic branch of the development curve and permit the assumption that, beginning in the 1950's, this parameter reached "saturation."

Although, during this same span of time, the per-unit drive power of a metal-cutting machine tool increased on the average by a factor of almost 2, the energy intensity of machine tools practically did not change, that is, in this instance, there was a break in the pattern, expressed in increased energy intensity with the growth in per-unit capacity.

To explain this fact, let us return to the model of forming technology adopted at the beginning of this work. This technology model, as a combination of methods and equipment, should also describe an individual component of this combination -- forming equipment. To analyze the processes taking place within the subject -- forming equipment -- we will divide it into subsystems, which transform each of the basic input flows: energy, information, and transportation.

The energy subsystem delivers and transforms the energy necessary for the forming process. Into it go the elements that store, transmit, and transform energy, and also that absorb reaction, that is, engines, drives, and, in addition, all elements of construction that absorb mechanical reaction during processing.

The information subsystem controls the flow of energy and materials, providing for their delivery in a given form and quantity at a given work place. Into it go all the elements that "remember," that transform and transmit information to the manufactured item.

The transportation subsystem provides for the flow of basic and auxiliary materials necessary during processing, which also determines the composition of its elements.

Under present principles for construction of metal-cutting machine tools, information and energy functions are borne by the same elements of machine-tool design. For example, the guide mounting absorbs working efforts, that is, it is an element of the energy subsystem. At the same time, the guides contain information concerning the rectilinear sections of the manufactured item and about the whole coordinate field of the machine tool relative to which the geometric information is read off during its transfer to the stock.

The desire to improve productivity leads to the increase in energy intensity of the energy subsystem of present machine tools. But its elements simultaneously go into the information subsystem. Increased energy flows increase the distortions (elastic and temperature) of these elements, that is, they introduce disturbances into the information transmission channel and do not permit the production of a component with given precision. To eliminate such disturbances, the designer must increase mechanical hardness and also the heat-radiating areas of the machine-tool surface, and this requires additional expenditures of construction materials.

In accord with the statistical data, a maximum level of energy intensity on the order of 5 W/kg corresponds to the current level of demand for precision and design principles for metal-cutting machine tools. If requirements for precision are raised, this figure is lowered (the noted lowering of energy intensity by 11.5%, which took place basically at the end of the 1960's, we explain as a 1967 tightening-up by 40 percent of norms for machine-tool precision.

The realistic way to lower unit metal content, in our opinion, is in the isolation, in machine-tool design, of autonomous energy and information blocks and in the rejection of the existing principle of combining these functions in the same constructive elements. Elements of the purely energy subsystem can then be calculated for durability rather than hardness, and this will permit lowering their mass by approximately an order of magnitude. Elements of the information subsystem, freed from the necessity of carrying mechanical and thermal burdens will be accomplished in the form of instruments, the mass of which is evaluated in percentages of the mass of today's machine tools. Designed according to this principle, machine tools with the same productivity will require an order of magnitude less construction materials.

We consider this way to be realistic, and this is supported by reports of the creation of operating mock-ups of such systems. In a Japanese report, the guides of an ordinary lathe machine tool were used as purely an energy element -- for absorbing reactions, and the rectilinearity of the transfer (purely an information function) was provided for by a control system using the straight line of a laser beam as a standard.

In a British report, hydrostatic mountings of a platform for a heavy machine tool are used as purely an energy element, and the rectilinearity of movement is provided for by a control system with a straight line standard in the form of a pair of taut wires.

The principle of a physical separation of information and energy subsystems will provide a large effect, particularly in heavy machine tools, the coordinate field of

which is measured in meters, and also in precision machine tools (in both types of machine tools, the most critical effects are those of temperature and elastic deformations of information subsystems). The introduction of this principle also provides for reduction in labor content in the manufacture of metal-cutting machine tools. An objectively contradictory task is being placed before machine-tool building at the present time -- the creation of durable and massive designs with instrument precision. With the separation of the energy and information functions into autonomous blocks, machine-tool building can be specialized in the creation of energy and transportation subsystems, and the information subsystems can be made by instrument-making sectors that are specialized just in this area.

Let us stress that, to create autonomous information subsystems, there needs to be a significant amount of scientific research and experimental-design work. It is necessary to work out theoretical principles and the design of a coordinate system of a machine tool (we have already mentioned the laser and wire prototypes for elements of these systems) and to find a general solution in principle for a detector of current geometric information on the manufactured item and to bring it about in design suitable for use in machine tools of all types.

The problem of the energy subsystem has been worked out more fully, but here also there must be improvement in the discrimination capability and high-speed drive supply.

All this work cannot be accomplished by the efforts of one machine-tool building sector. In addition, its accomplishment is important for a number of sectors that use forming technology in the broad sense that was defined at the beginning of our work.

The high degree of stability and narrow limits of change in the parameter of energy intensity for metal-cutting machine tools, and also the analysis of the physical processes that it reflects, permit using this parameter as a basis for a unified classification of machines. With this, the following generalization (according to I. I. Artobolevskiy) attaches to the concept "machine": "A machine is a device created by man to study and utilize the laws of nature . . . "

Statistical research on this parameter was conducted for various machines and machine systems. The results of this research are introduced below:

Type of Machine or System	Energy Intensity W/kg
Internal combustion piston engines	100 - 1000
Electric motors	80 - 120
Electric drives with continuously variable regulation of rotation frequency	10 - 50
Forge-press machines	1 - 7
Analog computers	2 - 6
Industrial work	1 - 5
Pneumatic weaving looms	3.0
Metal-cutting machine tools	0.5 - 5

Type of Machine or System	Energy Intensity W/kg
Digital computers	1 - 5
Key-activated calculating machines	0.3 - 1.5
Card-punch activated calculating machines	0.3 - 1.0
Weaving looms	0.5 - 0.7
Coordinate measuring machines	0.2 - 0.5

The upper part of the table shows specialized energy machines, the single function of which is to transform energy from one form to another. They are characterized by a high value for the indicator of energy intensity -- 100 to 1000 W/kg. Such a high indicator in energy machines will be reached because the density of energy flow to them is determined by the strength and heat resistance of the construction materials.

The lower part of the table shows specialized information machines. Their function consists of transforming information to analog, digital, or analog-digital form. These machines are characterized by low (0.1 to 10 W/kg) energy intensity, which is limited by the admissable level of interference in the transformation of information. For purely mechanical information machines this level is determined by workers' efforts and the hardness of the machine elements and also by the admissable thermo-elastic deformation.

For information machines with electronic components, the level of interference is determined by more subtle physical effects at the solid level, which is more sensitive to the heat of the machine.

Still another form of specialized information machine is the coordinate-measuring machine (CMM), which has appeared during the last decade. Its purpose consists of transforming analog information, included in measurements and form of a prepared component, in a digital form necessary for establishing correspondence of the component to the drawing.

All presently existing CMM use a mechanical, kinematic principle to produce digital information, that is, these machines can be looked upon as inverse metal-cutting machine tools (incidentally, the first CMM literally were made that way -- on the basis of precise coordinate-boring machine tools, by means of supplying them with a measuring probe instead of a cutting tool).

The precision in the transformation of information with the aid of a CCM is approximately an order of magnitude greater than on a metal-cutting machine tool, and the energy intensity of the CCM is approximately an order of magnitude less: 0.2 to 0.5 W/kg.

In the middle of the table are various machines that combine information and energy functions. They consist of information subsystems necessary for control of the physical working process and energy subsystems that deliver energy to a given place and in the form that is needed for accomplishing the physical working process. The level of energy intensity of these machines depends on the ratio of energy and information functions in them, and also on construction principles -- on how much

the information and energy subsystems intersect in the design elements, which was shown in the example of the metal-cutting machine tools.

Analyzing the unified classification table, we see that the energy intensity of metal-cutting machine tools does not exceed the energy intensity of such specialized information machines as digital computers, although other physical principles are used for transforming information.

The place occupied by forming machines in the unified machine classification confirms the correctness of the hypothesis that the determinant process in forming is the transfer of information (it is interesting to note that, of all the transformers of in ormation, the human mind possesses the highest degree of energy intensity -- obviously, it uses more "interference-resistant" principles for transforming information, which permits reaching the energy intensity level of 5 to 10 W/kg.

From the reversibility of analog-digital and digital-analog transformations based on the same kinematic principle, it follows that the energy intensity of hypothetical future machine tools, from which the precision of present CMM is required, cannot exceed the magnitude of 0.2 to 0.5 W/kg. Even if it is assumed that the absolute productivity of such machine tools (according to V. I. Dikushin) will not be raised, an order of magnitude more metal will be required for them than for existing ones. Only a transition to a new principle of design -- the separation of autonomous energy and information subsystems -- will permit the solution of the problem of reducing metal content. To solve the second problem -- the reduction of labor content -- the composition of these subsystems must provide for the capability of controlling the precision of the manufactured item.

Thus, in maintaining the present trends toward reducing the series of the products of forming technology, it would be advisable to give primary attention to the developmment of the controllability of these technologies; it is also necessary, for primary forming, to develop devices for producing information on the current geometric parameters of the manufactured item during processing.

Substantial, multiple increases in the productivity of forming equipment with the simultaneous reduction of the labor content in its manufacture, and also of materials content, can be achieved only as follows: the development of autonomous constructive blocks that accomplish purely energy or transportation functions and purely information functions; the specialized manufacture of these blocks by appropriate economic sectors; and the assembling from among them of machines for specific tasks with consideration for the possibility of regrouping machines with changing tasks. (The latter stems from the necessity for optimum utilization of the functional capabilities of these machines.)

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NEW METHODOLOGY TO EVALUATE EFFECTIVENESS OF ECONOMIC MEASURES

Moscow EKONOMICHESKAYA GAZETA in Russian No 1, Jan 82 p 9

[Article by G. Mikerin, scientific secretary of the commission to develop a comprehensive technique: "New Technique for Efficiency"]

[Text] Preparation of a new comprehensive technique for evaluating the efficiency of economic measures is currently underway. The decision to develop it was made in 1980 by the USSR State Committee on Science and Technology and the presidium of the USSR Academy of Sciences. The technique should eliminate the significant differences present in the active method documents in the methods of determining efficiency in selecting variants for capital construction, cost-accounting activity, price formation and in developing planned economic standards. It must guarantee a unified method approach in solving these questions.

Scientists of economic institutes, representativesof ministries and departments, workers of higher educational institutions, and leaders of large production associations and enterprises are participating in this work.

The initial draft of the comprehensive technique was discussed at the end of 1981 at a joint meeting of the office of the Department of Economics of the USSR Academy of Sciences, Scientific Council of the USSR Academy of Sciences on the comprehensive problem "Optimal Planning and Control of the National Economy," the interdepartmental expert council on methodology and practice of improving the economic mechanism and the scientific council of the central economic-mathematical institute of the USSR Academy of Sciences.

The draft of the technique includes principles and methods for defining economic standards, prices and estimates of labor and natural resources, as well as method recommendations for evaluating the efficiency of social production; its permutation; introduction into the national economy of new equipment, inventions and efficiency experts' suggestions; capital construction; foreign economic ties; measures in the sphere of circulation and nonproductive sphere, for improvement in use of nature and control of production.

Other work on the technique proposes broad approval of the suggested methods in the sectors of industry and in other spheres of the national economy. A refined draft of the comprehensive technique will be prepared in 1982 with regard for the obtained results, as well as the remarks and suggestions coming from the scientists and practitioners.

9035
CSO: 1814/61

ACADEMICIAN KOSYGIN ON STRENGTHENING TIES BETWEEN SCIENCE AND PRODUCTION

Moscow EKONOMICHESKAYA GAZETA in Russian No 51, Dec 81 p 14

[Article by Yu. Kosygin, academician, director of Institute of Tectonics and Geophysics of the Far East Scientific Center of the USSR Academy of Sciences, hero of socialist labor: "Draw Science and Production Closer Together"]

> [Text] The country extremely needs the efforts of "great science," in addition to development of theoretical problems, to be concentrated to a greater measure on solving key national economic questions, on discoveries capable of introducing truly revolutionary changes in production.
>
> L. I. Brezhnev

The territory of the Far East is commensurate with the territory of West Europe, but its development and degree of study are incomparably lower. An enormous range of activity is opening up for scientists here. Science in our kray plays a founding role. It seems to lay the paths towards mastery of the depths and development of production. Its task is to achieve those results which could be introduced into the national economy as fast as possible, and yield an economic effect. This basically concerns not only geology and not only the Far East, but I think that the founding role of science is manifest more clearly here.

Why Obstacles Develop

It would seem clear that science must be merged with production. This is the only natural path for its efficient development. However, I note that such phrases as "science and production," "science to production," hide indications of the existence of boundaries between them. In fact, a continuous transition from scientific thought, from "generation of ideas," through a number of successive stages to a specific practical result exists. If in this transition from idea to result, boundaries develop which are difficult to overcome, then this is primarily associated with organizational defects.

In this respect the 26th CPSU Congress and the report of Comrade L. I. Brezhnev at the congress provide us with a quite clear orientation: "Scientific research and planning-design work should be brought more closely together, economically and organizationally with production."

It seems to me that if an institute operates on a previously compiled plan and obtains results in 3, 5 or sometimes 10 years, and then transfers these results to production, then often it is not taken into consideration that during these years production also followed its own path, although not so straight as the path selected by research. As a result, great difficulties are created with introducing into practice the results of scientific searches. The scientists have to waste great efforts on this, and sometimes encounter insurmountable resistance on the part of the production engineers. Why does this occur? This occurs because the paths of the workers of science and production have imperceptibly diverged. It is already very difficult to bring them closer together. The introduction of a scientific result which promises great economic profit will be tied to breaking of production, breaking those new production norms that have been established during this time.

It is another matter when scientific workers and production engineers work all the time in close contact, where real fusion of science and production occur, and a constant scientific-production friendship develops, if one can call it that. In this interrelationship, the scientists daily feel the rhythm of production and the trends of its development. Knowledge of these trends "deform" the idea of the scientist to the necessary approach. By constantly feeling the needs of production, the scientist aims his research at the path which the requirements of life dictate.

But this is not the only advantage of real fusion of science and production. There is another which consists of the rate of the process of introduction, of reduction, and perhaps even of elimination of obstacles in this case. The 26th Party Congress stressed that production can be vitally interested in developing more rapidly and in a better manner the fruits of thought, the fruits of the labor of scientists and designers, and that solution to this task is not a simple matter which requires breaking outdated habits and indicators, but is quite necessary for the country, for the people and for our future.

Two Paths of Integration

In my opinion, there are two paths for merging science and production. The first is organization of scientific-production associations as large scientific-production enterprises which are organizationally and administratively formed. In other words, we are speaking about the development of scientific-research institutes and laboratories in major industries.

By the way, the production geological associations (PGO) which are related to me by specialty and which number dozens in our country, were "born" back in the years of the first five-year plans from the then-natural geological institution of the country, the Geological Committee. The committee was a scientific institution, and the associations (they were previously called trusts, administrations, etc.) were fairly saturated with scientific workers, and many of them had curators (scientific consultants) from among the major geologists in the country. However, later the scientific "shell" (or "stuffing") of the associations began to gradually melt, then numerous regional sector scientific research institutes began to appear and grow.

This resulted in two bad consequences. First of all, science began not only to be separated, but also to be removed from production, and secondly, a regional scientific barrier developed between highly skilled workers of the central institutes of production. Now it was not so easy to find a "scientific star" that would be closely tied to the geological association. One can say that I am not correct, and cite contradictory examples. Yes, there are such examples, but they are rather the exception than the rule.

In any case, integration of science and production in geology is necessary. Organizational measures must be well thought out and not fast. The decisive improvement in efficient search for mineral raw materials depends on them. We often attempt to cover the gaps between science and production by creating numerous commissions, councils, "working groups" and other ephemeral formations which often only create an illusory effect, and result in contradictions, disruption in the rhythm of work and excess nervousness.

The second path is to create groups for joint development of scientific tasks, such groups which would include scientists and production engineers. Then they would work together and they would develop common interests. The achievements of science in this case would pass directly from the scientific colleagues to the production engineers, and vice versa.

Experience of the Institute

Our institute has such experience. For example, we are starting up general work together with workers of the production geological association. We are conducting this work on two levels, strategic and tactical.

By strategic level I mean bulk scientific developments in which leaders of scientific institutions and production enterprises participate. This type of development would provide a long-term program for action both for science and for production, and determine the trends for work. For example, jointly with the leaders of all the institutions of the Far East which are involved with searching for oil and gas (in particular "Sakhalinneftegazprom," "Sakhalingeologiya"), we are conducting scientific development on problems of oil and gas content in the territory of the Far East and outlook for development of work in the near future.

Thus, the most urgent in the sense of developing new oil and gas basins was an accurate comparison of geological deposits of North Sakhalin and West Kamchatka solved on a computer. Our scientific colleagues created a special technique for this purpose. We are continuing this work jointly with the Sakhalin institutions of the Ministries of Geology and the Gas Industry.

The creation of basically new methods for ore search is urgent today. They are now being successfully developed by our scientists and the workers of "Dal'geologii." The essence of the method is that measurements of the geophysical field on the surface reveal several tens of kilometers of indicators in the depths which make it possible to search for ores on the surface of the earth. This is a new step in science and practice. Our scientific and production interests here are inseparable.

Scientific research groups which consist of scientific workers and workers of production are solving more particular tasks, following a common course. This does not mean, of course, that a common course has been worked out for time eternal. In accordance with the new data, we are always ready to flexibly alter it, but nevertheless, our "strategic" work serves as a landmark for research of a more particular profile.

Organization and Stimuli

The question now is raised: what is the organization of this work and which stimuli should be used in setting up combined scientific research groups?

I will note some aspects from our practice in this respect. We have an agreement for joint publication of work. This interests all the participants of collective work. Another form is coordination of the institute of training of highly skilled cadres of production engineers. Many candidate dissertations presented by production workers have already been defended and this is very important.

I would like to further indicate the experience of interexchange of cadres which is important from our viewpoint. For example, jointly with "Dar'geologiya," we have established the following order: a scientific colleague who is actively participating in production life is numbered in the association as a scientific consultant on public principles. As we consider, it is necessary to have for this purpose a scientific degree, and of course, the agreement of the leaders of both organizations. On the other hand, the production workers in the case of successful joint work, also on public principles, are numbered among the non-staff scientific colleagues of the institute. This type of penetration of scientific workers into production and production engineers into scientific institutions is an important and good stimulus for cooperation.

I would like to also speak about the criterion for evaluating the activity of scientists. The number of scientific publications is usually considered this criterion. Some scientific colleagues expand the list of their scientific publications by newspaper articles, prefaces, short remarks, etc. A lot of attention is given to their number: say for example one says that he has 100 scientific works, another 200 but no one usually finds out what is hidden behind this. What is most important is not the number, but what stands behind this number. This is why it is necessary to formulate criteria for evaluating these works. Valuable works can be considered those, for example, which not only receive acclaim in the scientific press, but also which are interesting in the production sphere where the expected effect of work can be evaluated jointly by scientific workers and production engineers.

In short, it is necessary to have a creative approach to the problem of regrouping scientific forces so that close cooperation of science and production in fact would embody, as Comrade L. I. Brezhnev said, "an indestructible union of creative thinking and creative labor."

The expansion of activity of the academy of sciences in a territorial respect plays a significant positive role in the interests not only of integrating

science and production, but also advances of basic scientific development. I have in mind the creation of the Siberian department, Far East and Ural scientific centers. The development of basic scientific research locally intensifies their role as "catalysts" for applied research which has a direct outlet into production practice.

9035
CSO: 1814/65

EVALUATING RESULTS OF SCIENTIFIC WORK REMAINS CRITICAL PROBLEM

Minsk SOVETSKAYA BELORUSSIYA in Russian 18 Feb 82 p 2

[Article by S. Nekrashevich, deputy chairman of the unified trade union committee of the BSSR Academy of Sciences: "Science Lies Behind the Points"]

[Text] An important tool for improving labor intensification of scientists, their creative and social-political activity is socialist competition. Today you no longer hear discussions that competition in science is an unnecessary matter, that it is only applicable in the sphere of material production. The efforts of the competitors are aimed to a greater measure at reducing the periods for development and introduction into practice of new equipment and technology, comprehensive mechanization and automation of production, improvement in labor productivity, and conservation of material and financial resources, fuel and energy.

Organization of competition in the scientific institutions of the BSSR Academy of Sciences is a fairly developed system. A single methodology for summarizing includes an evaluation of all five basic types of scientific activity: research and development, introduction of their results into the national economy, publication of scientific works, training of cadres, scientific-organizational activity. In addition, such indicators are also taken into consideration as awarding the Lenin, State Prizes, Prize of the Leninist Komsomol, prizes and medals of the leading scientists; decisions on issuing diplomas for discovery, certificates of authorship, patents for sale of licenses, approval of the state standard, adoption by the state commission of new instruments or used, new types of drugs, types of plants, etc. The socialist commitments of the scientific-research institutes reflect cooperation of labor and industrial enterprises which are expressed as concluding of contracts on creative cooperation and economic contracts.

Nevertheless, on the scale of the academy with such a different profile of institutes it is very complicated to organize interinstitute competition. It is impossible, for example, to compare the results of work of institutes of social profile and technical. However, a solution has been found. Special commissions which have become the organizers of competition between the institutes have been set up in all five departments of the BSSR Academy of Sciences. A differentiated approach to labor competition between institutes which are close in profile made it possible to guarantee better comparability of results of the work, competitiveness, and reveal all that is valuable and leading in time. Many of our

institutions have accumulated positive experience of organizing competition, but it has been set up best of all in the Institute of Electronics of the BSSR Academy of Sciences. Combination of improved control and organization of labor with creative initiative of the colleagues has fostered success here. The institute has achieved high indicators in the first year of the 11th Five-Year Plan and has taken first place in the department of physical-mathematical sciences of the BSSR Academy of Sciences. It became known recently that this collective has been acknowledged the winner of the all-union socialist competition among scientific institutions of the USSR Academy of Sciences and republic academies.

However it would be incorrect to believe that our level of organization of competition completely meets the tasks of today. There are broad potentialities for improving efficiency and quality of scientific research, accelerating scientific and technical progress. Competition is not always used as a means for controlling shallow subject matter, diffusion of efforts and material resources. The adopted socialist commitments are often overloaded with secondary questions, and sometimes work plans of the administration and local committees are copied.

In the sphere of science, one of the most complicated questions remains the formulation of an efficient system for evaluating the activity of collectives and colleagues. It must not only guarantee the necessary level of comparability of results, but also foster a substantiated identification of the winners, analyze and reveal the reserves in the work of the lagging.

Experience has shown that the system of relative indicators which serves as the basis for expert evaluation of both scientific-production activity, and the level of completed scientific work, ties to production, and efficient use of scientific equipment has justified itself the most. At the same time, the point system adopted in many institutions for summarizing results often does not justify itself. If the winners of the competition are defined only by a set of points for scientific, political-educational and social work, this will inflict enormous damage on the competition, and be a formal approach to the matter. Competition is a creative matter. Practice has not yet worked out those criteria which would make it possible to compare activity of representatives of science which is so different in its nature and content.

What points, for example, can be used to measure and compare the significance of a monograph and a scientific article? Or to compare the labor of a researcher involved in basic problems of sciences, and a scientist implementing applied developments? Therefore quantitative estimates, in our opinion, can only serve as an auxiliary tool in summarizing the results. The final solution must be made by skilled specialists.

We will show this in the example of the Institute of Physics. For several years a system of estimates of results of the labor of research subdivisions has been successfully used here. It makes it possible to achieve the greatest efficiency of competition. The criteria for determining the "weight" of a certain type of scientific activity, consequently, the contribution to science of a certain laboratory are hardly rigid or equivalent for many years. The institute leadership together with the social organizations use them as an additional tool in

evaluating the activity of the subdivisions of the collective. They serve as a unique lever which makes it possible to extend those trends in work which have not obtained sufficient development.

For example, for a number of years, the Institute of Physics has been lagging in the number of orders for proposed inventions. In order to pull up this indicator, they had to raise the coefficient of significance of the corresponding division for competition conditions, and at the same time create interest of the laboratories. As a result, there was a drastic improvement in the efficiency of invention activity. In the last 5 years, the number of orders filled rose by almost 50 percent, and the number of obtained certificates of authorship rose from 10 in 1975 to 80 in 1979. Thus, stimulation of this indicator reinforced by organizational-mass work of the party and social organizations permitted the institute in 1980 to take second place in the competition among the collectives of inventors and efficiency experts of the BSSR Academy of Sciences.

We usually summarize the competition results no more than once every 6 months. In our opinion, this period is the optimal for academic institutes who are working on basic problems. A shorter period (a month or quarter) is not only nonindicative, but also leaves a loophole for those who are attempting to accumulate victory points by any means with the minimum expenditures of labor.

Creative competition of sciences is also developing in other forms. Contests, including for best scientific work, best introduced development, best inventor, efficiency expert, and for the title best in profession have become popular. These contests are an important factor in improving creative activity of the scientific workers. They make it possible to correctly evaluate the theoretical and practical significance of a certain work. In our opinion, the contests must remain one of the basic forms of competition in scientific research institutions.

Socialist competition promotes the creation in each scientific collective of a situation of truly creative search, true competition and comradely mutual help, high degree of responsibility for work entrusted, and intolerance for shortcomings.

9035
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NATIONAL ECONOMY TO IMPROVE FROM BETTER ORGANIZATION OF SCIENTIFIC RESEARCH

Kiev EKONOMIKA SOVETSKOY UKRAINY in Russian No 1, Jan 82 pp 63-66

[Article by L. Denisenko: "Improvement in the Organization of Scientific Research (In the Example of Academic Institutes of a Chemical Profile)"]

[Text] The tasks advanced in the Basic Directions for Economic and Social Development of the USSR for 1981-1985 and the Period to 1990 in the area of science and technology focused the attention of the scientists on solving the most important problems of scientific-technical and social progress. Their fulfillment requires improved organization and planning of scientific-research work, better use of scientific cadres and the material-technical base, strengthening of the interest of the workers from the institutions, improvement in their responsibility for the results of research, for accelerated introduction of results into the national economy.

It is common knowledge that the level of organization of scientific research and development determines the degree of use of the potentials of a scientific institution. Therefore questions of improving the organization of scientific research, financial and material support and strengthening the scientific activity of the colleagues acquire especial urgency. Such indicators depend on their correct resolution as the duration of the research cycle, annual economic effect obtained from introducing the developments of institutes at enterprises, number of certificates of authorshin, patents, licenses, publications, public acknowledgement of the results of research, level of skill of the cadres, etc.

With a constant rise in the investments to basic research in the USSR, a trend is observed towards a not always justified growth in expenditures for applied work[1] whose financing comes primarily from the state budget. Consequently, it is especially important to determine the quantitative ratio between the basic and applied research, and to establish the optimal proportions between the volumes of expenditures for them.

The results of basic research are the basis for subsequent applied work. Consequently, their ratio must promote both the accumulation of a scientific reserve, and the creation of prerequisites for the continuous influx into production of new scientific ideas, for the successful solution to problems which develop in various sectors of the national economy. It is therefore

necessary for the rates of development of basic research to outstrip the rates of development of applied work. In addition, in establishing the structure for outlays it is important to take into consideration the profile of the institute and the specific nature of the research done in it. It is natural that expenditures for basic research must dominate in the academic institutes which are "idea generators."

There are currently no established criteria for determining the optimal structure of outlays for science and techniques for computing them. For example, M. Bashin[2] believes that in the structure of outlays for the development of science in the USSR, basic research is 12.9%, applied 60.5% and development 26.6%. V. Pokrovskiy[3] proposes the following structure of outlays for different types of scientific research and experimental design work: basic research 14%, applied 22%, development 64%. N. Zhavoronkov[4] raises the question of determining the optimal ratio between the scientific research and experimental design work. He suggests one-third of the allocations be spent on scientific research, and two-thirds on experimental design work. According to the calculations of Ukrainian scientists[5], the proportion to which the expenditures for basic and applied research, and for development, should be distributed, and the expenditures for developing innovations is 1:4:16:250. A number of Soviet scientists[6] admit that it is expedient to distribute capital between basic science, applied research and developments in a proportion of 1:2:4. In a percentage ratio, these proportions will be the following: for basic research 14.3%, for applied research 28.7%, for development 57%.

We will examine how the ratio of individual types of research in the academic institutes of the chemical profile of the Ukrainian SSR Academy of Sciences was actually formed. Each of the institutes occupies a leading position in its field. They perform three types of studies: basic, theoretical with the outlet of practical results into production, and applied. The ratio for individual types of work according to the sum of expenditures averages 1:1.5: 1.6. However the type of conducted research is not indicated in the thematic charts for the institutes during planning. There are cases where a number of topics classified as basic problems in the field of natural sciences are simultaneously aimed at solving important applied tasks. This naturally impairs an analysis of the formed proportions and the establishment of the optimal proportions between them. On the whole there was a reduction observed in the specific weight of the conducted basic and target theoretical studies and increase in the number of applied works in the section of chemistry and chemical technology (OKhKHT) of the Ukrainian SSR Academy by 1979 as compared to 1971. However, these proportions vary in individual institutes. Basic research aimed at solving problems in a general form, and target theoretical studies made in order to solve a large practical task dominate in the institute of physical-organic chemistry and carbon chemistry of the UkSSR Academy of Sciences (on the average 85.9% and 84.2% of the total number of subjects). A lot of work to solve tasks elicited by the specific needs of industry is being done in the institutes of gas of the UkSSR Academy of Sciences (81.3%), chemistty of high-molecular compounds of the UkSSR Academy of Sciences (54.1%), general and inorganic chemistry of the UkSSR Academy of Sciences (53.4%).

In order to increase the percentage of outlays for basic research, it is necessary to implement the "development" stage completely at the experimental plants of the institutes through interested organizations. The form of calculations between them can be both contracts for fulfillment of scientific research, and contracts for transfer of documents to other enterprises. This will allow the institutes to free up and redistribute for other purposes an average of up to R 300,000 per year. It should be noted that the institutes currently detract a lot of time and resources for bringing the applied research to the stage of introduction, that is, actually together with the colleagues of the experimental production of the institute, they develop the technical conditions for the production of the product, a chart of the technical level and the technological regulation. This work takes an average of 3 months for each development. The institutes pay for the participation of the experimental plants in developing the technical documents. Up to 57.5% of the resources stipulated in article 5 (materials) are spent on these orders.

The formed structure of expenditures cannot be considered optimal once and for all, but should be viewed in dynamics, based on the specific conditions and tasks which the institutes have to solve. In determining the volume of financing, it is necessary to start not from a single control figure set for the institutes regardless of the number of topics to be fulfilled and their estimated cost, but to take into consideration both these factors and the formed ratio of expenditures by types of research in the given period of time. In other words, financing of the scientific research work must be target, by topic, and not financing of the activity of the scientific research institute. It consequently becomes necessary to have a more substantiated determination of the cost of individual types of research. Thus, analysis of the consumption of resources allocated by the institutes of the OKhKhT of the UkSSR Academy of Sciences for the period 1971-1979 showed that in different years the institute can fulfill from 17 to 43 state budget topics with the same amount of financing. The average cost of one work in this case can fluctuate from R 52,000 to 180,000 with the same labor expenditures for its fulfillment. In addition, often the final cost of the study differs from that initially set by a considerable sum. This is associated with imperfection in the actual methods of determining the estimated cost of the scientific research work which can partially be explained by objective reasons: high percentage of creative work in carrying them out, probable nature of achieving positive results in the assigned periods.

Based on the conducted analysis of the expenditures for previously completed work, we developed standards of expenditures for topics. Introduction of these standards in planning scientific research work and defining the annual volume of financing of the institute will provide the possibility for a more substantiated correction for the estimated cost of scientific research work during its fulfillment, redistribution of the resources between individual types of research and guarantee financing of the most promising trends.

For purposes of more efficient organization of calculation of the actual outlays by topics which is difficult for all institutes, especially when the department is fulfilling several topics, it is expedient to extend the practice of computing the expenditures for scientific research work that we suggested and which was tested in the IKhVS [expansion unknown] of the UkSSR

Academy of Sciences. It is suggested that the following formula be used for this:

$$З_t^г = Ф_t^г(1+d_m+d_{об}+d_н), \tag{1}$$

where $З_t^г$ --actual expenditures by topic in the current year; $Ф_t^г$--annual fund of wages of the colleagues working on this topic; d_m--ratio of expenditures for materials and experimental work to the fund of wages; $d_{об}$--ratio of expenditures for equipment to fund of wages; $d_н$ --ratio of expenditures for overhead to fund of wages.

The total outlays for a topic to be worked on for a number of years are:

$$З_t = \sum_{i=1}^{n} З_t^г, \tag{2}$$

Increase in the efficiency of scientific research also depends on the establishment of the optimal structure of outlays between the budget and economic contract subject matter which as a whole for the OKhKhT of the UkSSR Academy of Sciences was (in %): in 1971 73:27, in 1979 60:40, and the average for 9 years, 67:33. By 1979, the largest specific weight of the economic contract work in the total outlays of the institutes was at the Institute of Gas and the IKhVS. Whereas in the Institute of Gas which has a large number of applied projects, this ratio was constant for 9 years, in the IKhVS it was induced by the insuffcient material support for the subject matter of the institute through capital from the state budget. Thus, according to the plan for the beginning of 1979, in the IKhVS, the ratio of expenditures between the state budget and the economic contract subject matter was (in %): 64:36. Of the capital planned for the institute, 65.7% was for article 1 ("wages"), 9.7% for article 5 ("scientific research work"), 7.4% for article 12 ("equipment acquisition"). With this financing, the institute cannot guarantee continuous operation of its subdivisions, and annually concludes an additional number of economic contracts. Thus, with a plan of R 400,000, economic contract work was conducted: in 1979 for a sum of R 710,000 and in 1980 for R 800,000. The resources for articles of outlays "wages," "scientific research work," and "equipment acquisition," were respectively 44.2%, 20.5% and 16.4% from the total volume of financing. The ratio of outlays between the state budget and the economic contract subject matter was 46:54. This contradicts the nature of the basic activity of academic institutes aimed at developing basic research which generally cannot be financed through economic contract receipts. The wages fund planned by the institutes does not depend on the sum of the economic contract capital actually obtained by the institutes. No limits are made for the institutes on the labor for fulfillment of above-plan work. Consequently, they do not have the necessary number of colleagues and work is only done through increased labor productivity.

The structure of outlays between the state budget and the economic contract subject matter can be improved by increasing the allocations for the institutes from the state budget for articles 5 and 12, since the level and quality of conducting the scientific research, strengthening of discipline and improvement in labor productivity of the scientific workers depend a lot on the supply of new high-quality materials and equipment to the scientific institutions.

Contracts for fulfillment of scientific research should be aimed both at applied research which will increase the percentage of allocations for basic work through state budget resources, and at experimental-industrial verification and introduction of developments of the institutes into the national economy.

President of the UkSSR Academy of Sciences B. Ye. Paton defined the relationship between the state budget and economic contract subject matter as roughly 60 and 40%.[7] Establishment of the optimal ratio of outlays between them will help to avoid an excessive increase in the applied side of scientific development. This may lead to a curtailing of basic, theoretical and research work and have a negative effect on the future rates of scientific and technical progress. In the academic institutes of a chemical profile, in the period of 1971-1979, the state budget allocations for science increased by 15.5%, and the outlays for materials and equipment by 39.1%. In calculation for one colleague, the first indicator increased by 24.1%, and the second decreased by 10.8%. The expenditures for acquisition of equipment through state budget and economic contract resources in calculation for one colleague on the average for 9 years in the OKhKhT of the UkSSR Academy of Sciences equal R 400. For individual institutes, this indicator changed from R 550 in the IKhVS to R 250 in the Institute of Gas. This is clearly insufficient for basic research at a high scientific and technical level.

It is extremely important for academic institutes to guarantee leading rates of growth in outlays for improving the fund supply in relation to the growth in total expenditures for scientific research. This will make it possible to provide in time for the demands for material resources by the scientific organizations during the research process. The actual system of material and technical supply of scientific developments needs improvement. It does not always ensure fulfillment of the institute orders for the accountability year. This means that the institutes often acquire less needed instruments and materials in order to spend the remaining sums. It is apparently expedient to set up funds of technical supply in the institutes. The resources for these funds should be carry-overs. This will permit acquisition of the necessary equipment and eliminate unjustified expenditure of capital at the end of the year. In addition to changing the system of financing the outlays for materials and equipment, it is necessary to improve the actual system of supply. Its essence is not only to satisfy the preliminary orders of the institutes, but also to guarantee the maximum efficiency in fulfilling the requests which emerge in the current year.

Setting of the optimal proportions between the outlays for individual types of research, budget and economic contract subject matter determines the need to provide the optimal correlation between the individual categories of workers as well. The institutes do not always make efficient use of the scientific colleagues. This is because of the shortage or nonuniform placement of the auxiliary technical personnel who average 18.1% of the scientific and engineering-technical workers. There is an average of 1.2 engineering-technical and 0.4 auxiliary workers for one scientific colleague. As a result, the scientific colleagues of the highest qualification waste a lot of time and effort on work which the auxiliary staff should do. For more efficient use of the scientific workers in the institutes of chemical profile, it is expedient to adopt the following ratio as the optimal: "scientific colleagues: engineering-technical and auxiliary personnel"=1:3 or 1:4.

For more complete use of the working time of the scientific colleagues, it is necessary to have an all-possible reduction in the outlays for different types of scientific-organizational, administrative-economic and auxiliary work. This is the main reserve for a more efficient use of working time of the scientific colleagues in conducting research on the assigned subject matter.

In order to improve the organization of scientific research, we should ensure in the institutes the optimal ratio between individual categories of workers, periodically, as far as needed, redistribute the executors among individual topics. This will not lead to a growth in the number of scientific workers, but will result in an improvement of their labor productivity, qualification and responsibility for the entrusted work. It is necessary to periodically review the structure of scientific subdivisions in the institutes as well.

All of these measures together will improve organization, and increase the efficiency and quality of scientific research.

FOOTNOTES

1. See: "Upravleniye issledovaniyami, razrabotkami i vnedreniyami novoy tekhniki" [Control of Research, Development and Introduction of New Equipment], Moscow, Ekonomika, 1977.

2. Bashin, M. L."Effektivnost' fundametnal'nykh issledovaniy" [Efficacy of Basic Research], Moscow, Mysl', 1974, p. 98.

3. Pokrovskiy, V. A. "Povysheniye effektivnost nauchnykh issledovaniy i razrabotok" [Improvement in the Efficacy of Scientific Research and Development], Moscow, Ekonomika, 1978.

4. Zhavoronkov, N. "Basic Scientific Research, the Basis for Technical Progress," KOMMUNIST, No 15, 1975, pp 72-81.

5. "Besedy ob upravlenii" [Conversations on Control], Moscow, 1971, p. 87.

6. "Ekonomicheskiye problemy nauchno-tekhnicheskogo progressa" [Economic Problems of Scientific and Technical Progress], Moscow, Ekonomika, 1970, p. 40.

7. Paton, B. Ye. "Eleventh Five-Year Plan: Tasks and Outlook," VISNIK AN URSR No 10, 1980, pp 3-14.

9035
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RAISING CADRE QUALIFICATIONS NECESSARY TO INCREASE PRODUCTION EFFICIENCY

Leningrad LENINGRADSKAYA PRAVDA in Russian 17 Feb 82 p 1

[Editorial: "Cadres for Science"]

[Text] The development of science and technology in the 11th Five-Year Plan is still subordinate to a greater degree than earlier to the regulation of the most important economic and social tasks, and increase in the level of social production. "...Science must be a constant shock to complacency indicating in these areas stagnation and lagging outlines, where the modern level of knowledge makes it possible to advance more rapidly and more successfully..." thus its tasks were formulated at the 26th Party Congress by Leonid Il'ich Brezhnev descriptively and precisely.

Their successful resolution depends a lot on the quality of training and education of scientific cadre, on the areas of knowledge and the national economy in which an intensive search will be made, and the directions in which science may begin to develop. These questions are especially urgent for Leningrad, where tens of thousands of scientific colleagues are working, including over a hundred actual members and corresponding members of the USSR Academy of Sciences and sector academies, and over 4,000 doctors and 35,000 candidates of science. Thousands of new specialists with higher qualifications annually enter this numerous crew. Their creative growth and the directivity at solving the most important scientific and technical problems must be constantly at the center of attention of party organizations of the VUZ's and sector institutes, the Interdepartmental Coordinating Council of the USSR Academy of Sciences in Leningrad, and the CPSU raykoms.

A lot of attention has recently been focused on improving the training and certification of scientific and scientific-pedagogical cadres. On the initiative of the oblast party committee, work was done to pinpoint the true need of scientific institutions and organizations in the cities for cadres of higher qualification, and the plans for acceptance for post-graduate work were correspondingly corrected. The structure of specialized councils in which over 350 doctoral and 4,000 candidate dissertations are annually defended now was also regulated. Improvement in their activity, and increase in exactingness resulted in a higher quality of scientific work and significantly reduced the number of dissertations rejected by the VAK [Higher Certification Commission].

One of the effective methods for improving the quality of training of specialists of higher qualification has become a universal preliminary examination of work. Consequently, weak dissertations which require significant finishing have not reached public defense. In the Leningrad State University, specialized councils have also organized review of dissertations by specialists. Work is discussed at scientific seminars and often joint seminars of several departments and laboratories.

Effective help and monitoring of creative growth of young scientists during all the post-graduate work has become the rule of many of the cities of VUZ's. A lot of attention has been focused on education of the scientific shift in the Leningrad Polytechnical Institute imeni N. I. Kalina, the electrical engineering institute imeni V. I. Ul'yanov (Lenin), and the technological institute imeni Lensovet. There is concern here not only for the scientific importance of the work, but also its practical use, and literally from the moment of confirmation of the topic, the most rapid production of an economic effect is planned. It has become a good tradition to hold conferences at the end of the school year which analyze and discuss the activity of the specialized councils. These conferences help the rectors, party committees and members of the scientific councils to critically evaluate the activities and to more accurately outline the ways to improve it.

At the same time, not only the quality of execution of the scientific work, but the actual selection of the topic, and tasks whose resolution has primary importance for the national economy at the given moment has recently acquired greater attention. To take this into consideration in training of specialists of higher qualifications means to use their scientific potential with the maximum efficacy. Now it is far from always possible to concentrate efforts on the most important trends for the Leningrad economy. Thus, in the last few years there has not been one, for example, defense of 138 specialties out of 286 approved by the doctoral councils. There was no defense in such urgent trends as automation in machine construction, planning and design of ships, technology of instrument construction, industrial thermal engineering, physical metallurgy and thermal treatment of metals.

At the same time, experience has shown that where the most promising direction has been selected, where the efforts of the collective are concentrated on the most urgent tasks of industry, there the scientific cadres develop most rapidly. In the Leningrad Institute of Aviation Instrument making, the number of specialists of higher qualification has increased greatly in recent years. This is primarily due to the increase in the number of works with important national economic importance, and the active participation of the institute collectives in developing national and regional target programs. To a considerable measure, the orientations of the VUZ on production needs promoted contracts on long-term creative cooperation between the scientists of LIP and the scientific production associations. They help to carefully select the "portfolio" so that from the very beginning of work on a dissertation, introduction of research results into practice is planned. There are also close ties between the Leningrad VUZ's and the production association "Kirovskiy Plant," "Izhorskiy Plant," "Elektrofila," the scientific production association imeni Polzunov and others.

Training of cadres for science and concentration of their efforts on the most important areas of social development is a complicated and multiple-stage process. A large role in it has been given to the intervuz coordinating council of the Academy of Sciences in Leningrad. Its task is to jointly with the specialized councils of the VUZ's, academic and sector institutes, and scientific-production associations to foster more accurate orientation of dissertations on the main trends of Leningrad economy.

A lot depends on control on the part of the party offices and committees, party raykoms for urgency of the themes of the dissertation work, the most rapid introduction, and the use of their results in practice, and finally the thorough selection of candidates for post-graduate work.

An important moment is beginning right now: plans have been approved for acceptance for 1982, topics are being pinpointed, meetings are being held in the departments with the future post-graduate students, scientific leaders are being appointed. It is important that the most trained and gifted young specialists are among the "new selectees" so that in all the work the post-graduate students will feel not only support from the Communist scientists, their leaders, but also strict monitoring and responsibility for the fruit of their work, and from the very start will be aimed at achieving weighty national economic results.

Not only their creative growth and formation depend on the resolution of all these questions, but, in the final analysis the contribution of Leningrad science to solving the most important tasks of the 11th Five-Year Plan.

9035
CSO: 1814/58

ACADEMICIAN SIDORENKO ON TRAINING YOUNG SCIENTISTS

Moscow KOMSOMOL'SKAYA PRAVDA in Russian 19 Mar 82 p 2

[Interview with Academician Aleksandr Vasil'yevich Sidorenko, a vice-president of the USSR Academy of Sciences and director of the Institute of the Lithosphere, by Yu. Danilin, correspondent of KOMSOMOL'SKAYA PRAVDA: "To Find His Way"; date and place not specified]

[Text] Scientific schools help the young scientist to find his way. The role of such schools and the problems of working with scientific young people were discussed by our correspondent with Academician Aleksandr Vasil'yevich Sidorenko, vice-president of the USSR Academy of Sciences and director of the Institute of the Lithosphere.

[Question] Aleksandr Vasil'yevich, the readers are used to the formula "young people and scientific progress." Traditionally, everything that is new, advanced, or innovative is close to young people.

I would very much like to know, Aleksandr Vasil'yevich, what this timely formula means at the Institute of the Lithosphere and also in the USSR Academy of Sciences Section on Earth Sciences, which you direct.

[Answer] It is difficult to imagine the sphere of my activity -- geology, geography, and oceanography -- without young people. The future of earth sciences is bound up with the energy and enthusiasm of young people and with their attempts to make their contribution to knowledge of the Motherland's natural riches.

It is characteristic that we have not simply put new regions into use, but have profoundly altered their social-economic infrastructure. There are a large number of such examples: these are in the northeast part of the USSR, and Yakutia and Kazakhstan. We would not have created anything without the organic unity of the knowledge, experience, and authority of the older generation of researchers and investigators and the enthusiasm of young specialists.

The number of the latter among the staffs of scientific institutions, scientific-investigating and sea expeditions is quite large. There are an especially large number of young people in the scientific collectives of geological and other expeditions in the Siberian North, the Far East, Central Asia, and Kazakhstan.

They go to these places eagerly. As a rule, they become well acclimatized and rarely leave. I know of many examples where they later become leading specialists -- candidates and doctors of sciences -- and are elected to academies.

It is gratifying to note that young specialists, as a rule, grow rapidly when they are not cut off from central scientific institutions and use their experience and knowledge. We in the USSR Academy of Sciences have always helped young scientists who come from the republics and from remote places for improvement in their chosen specialties.

[Question] The young scientist needs support; this is indisputable. And there are more than enough forms for such aid. In recent years, all-union schools for young scientists have been widespread, they are popular and, as their supporters maintain, they have good prospects. What can you say about this?

[Answer] The organization of the schools and the correct orientation of future young researchers toward leading scientific and practical problems that life brings forth are very important. The Institute of the Lithosphere of the USSR Academy of Sciences has introduced such a school in Tbilisi, devoted to new problems relating to formation of the earth's crust and its most ancient geological formations. Above all, I have experienced great psychological satisfaction from conversing with young, most attentive audiences. I want to share some thoughts about the school as a form in general.

The school, the very sense of it is in the direct intercourse between the older generation and the younger researchers and in the transfer of experience and knowledge to young people. They should try to make sense out of this sacred legacy, to stand on our shoulders and see farther than we see, and to go farther.

I am against those schools where they give dozens of lectures, sometimes already published, and the audience turns into a group of "schoolchildren." Our school also, it must be recognized, was far from perfect -- they heard more lectures than invitations to thought and conversation. Private conversation between the teacher and student, between the older one with the one to whom he passes the baton of his knowledge -- this is what we must strive for.

The scientific school as a form for training future scientists should not be a substitute for scientific conferences, meetings, and symposia. Schools are a bridge from the knowledge and experience of older people to the future that the younger people will create.

To organize a school does not mean to be limited to the propagation of the present level of knowledge, although this is also necessary. I think that the school should only begin the next step in the development of new scientific thought. Often also there are not enough specific actions for the continuation of school. This is probably our main shortcoming. Schools should come to an end when their organizers -- institutes or groups of institutes -- have selected young people for developing research, for helping the young scientist fulfill scientific work, or for preparing a candidate dissertation -- in short, for finding his own path which, perhaps, will then become an independent scientific road.

I would like for scientific schools to facilitate the development of close relationships between the young researchers of the country and scientists at central institutes. The USSR Academy of Sciences is prepared to offer positions in its laboratories to young researchers from other cities and to help them with consultations and preparation of scientific articles. Here, then, the school will be effective.

[Question] Aleksandr Vasil'yevich, it is no secret that after the candidate defense, there is sometimes a kind of "dead" period, and it can go on for years and even decades . . .

[Answer] I do not conceal my concern for the position of young scientists and scientific-assistant personnel. Many scientific collectives, with respect to age, are such that there are neither positions for young scientists nor any prospects for advancement whatever. Such institutes, naturally, are growing old. There is utilization of research probationers or junior scientific associates only as assistants who collect the necessary material for the project director. It is good when this collection becomes part of an independent article or future scientific work. The young researcher should feel prospects for growth, and he should have his own, even small, but independent section in the subject plan of the institute. We must search for forms for more broadly enlisting young people in the "old" institutes and to provide them more opportunities for creative growth.

You also hear that people come to science, thinking that it is easier than "getting stuck" or "doing engineering" in production. They are deeply mistaken. Science, if one is really engaged in it, is very heavy labor. He who thinks that it is simpler here than spending the winter in the Arctic, laying the Baykal-Amur Mainline, or working in a shop or plant every day, can expect a profound disappointment. Science demands complete dedication and selfless labor. The work of a scientist, whether a beginner or one who has achieved all degrees or titles, cannot be from 9 to 5.

There is yet another group of young people in science: engineers, technicians, and laboratory assistants. Institutes now more and more are being equipped with the most complicated technology for experimentation and analysis, and the role of the man who operates the instruments is sharply growing. If we do not teach them how to do this, we will not have reliable and qualified hands to operate the most complicated laboratory technology. Therefore, it is necessary to create conditions for the creative growth of scientific-assistant workers and to interest them.

Graduates of the schools often come to us. It seems that it is necessary to help them further to learn: at evening or correspondence departments of VUZ's, at technicums, and in courses for improving qualifications. It would be good to look at sending young people for apprenticeships to other collectives, particularly to factories where our instruments are made.

In institutes, there should be a psychological atmosphere where a young person can feel that to live through the day is not without purpose. And as for the "dead" period, the blame belongs, most of all, to the laboratory director and the section chief, but also to our sometimes not-very-high demands and lack of principle on the part of scientific councils. I will be nice to your student, and you be nice to mine. And everything works smoothly. Most of all in life, I am disturbed by the candidate of sciences who knows that he will not be a doctor of sciences or a doctor of sciences who becomes old baggage.

Working in a scientific-research institute is not like working at a factory machine, where reality itself requires results every day, making one go on. In science, there is great creative freedom and some opportunity to dispose of one's own work time. Every young specialist should understand this deeply and value it.

[Question] Judging by KOMSOMOL'SKAYA PRAVDA mail, the position of young researchers is sometimes still complicated by the fact that, at their humble places, they are far from the upper levels of the institute where the "final decision" is made. A conflict will take place with a director -- the decision is made, somewhere very high up, without any interest in what the junior scientific associate or laboratory assistant himself thinks. Yes, there are councils of young scientists and specialists and, in many institutes, they are really strong, but how can their effectiveness be enhanced?

[Answer] It seems to me that we have not determined everywhere their legal position or place in the life of the collective. And often we remember about them when we need to send them to help on a vegetable farm or a kolkhoz. The functions of the council of young scientists and specialists should be more substantial, and they can also be called upon to solve large, serious problems in the life of scientific collectives and to raise questions relating to the creative growth of scientific young people, and questions relating to social and educational work.

As for conflicts between the young specialist and his scientific director, they often seem to me not to be serious. As a rule, the creatively honest young scientist rarely finds himself in a conflict situation. I am not speaking about the scientific associate of the older generation who exploits the young specialist only for his own scientific ego or about the young careerists who are trying to get an advanced degree at any price. There is no place in science for either of these. In a healthy scientific collective, there is a large role for social organizations and the scientific council. In my view, they should give greater attention to councils of young scientists and specialists and take their opinions into consideration.

It is important to have openness and direct, uninhibited, even unpleasant, conversation when a "conflict situation" arises. In a collective with good psychological atmosphere, conflicts are based on differences in principle between scientific views and are resolved only on the basis of comparing scientific facts and mutual respect in scientific arguments.

The question of the position and role of young people in institute collectives, the forms of work and status of councils of young scientists and specialists, as well as procedures for selecting students for scientific work, must be improved.

In the Institute of the Lithosphere of the USSR Academy of Sciences, I sponsor the council of young scientists and specialists. Honestly speaking, I am dissatisfied with what I am doing; there simply isn't enough time. But if a young person asks me for help or has some question, I feel obligated to try to talk it over with him. I think that it is better to help him than to try to change one whom you will not change or you will not teach. It is well known that a tree, too, is transplanted only up to a certain age. Let this not sound like an insult to the older generation.

[Question] And how do you feel about the problem of "failures" in science? Is it perhaps really not so much a problem of "failures" as a problem of scientific managers?

[Answer] I think that the problem of "failures" both in science and in life is artificial; it is very convenient for the weak-willed, the nonpersistent and, I dare say, the lazy. If you have had bad luck somewhere with something, and you think about it, find the strength to evaluate yourself correctly. Find the courage to seek advice frankly with an older person, with someone you respect. Only, be completely sincere and not clever. I know of no instance where not only advice, but also assistance has not been given.

Failures have happened, are happening, and will happen at any age. By the way, the older you become, the greater will be both the difficulties and the failures. I am against those who use failure as a cover for their weak will and, sometimes, just laziness. I am also against the one who, not having worked with a person, throws him "overboard," not helping him or being involved with him. But, at the same time, I would like to say that young people should be more critical toward themselves and not think that life is a "silver platter" on which everything will be handed to you. Strive, create, and forge your own future for yourself. I am convinced that "he who works at it, works it out," that is, he who works for the good of society will be lucky.

9645
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SCIENTIFIC-ECONOMIC SOCIETY FORMED IN ALL-UNION COUNCIL OF SCIENTIFIC-TECHNICAL SOCIETIES

Moscow EKONOMICHESKAYA GAZETA in Russian No 13, Mar 82 p 10

[Interview with Academician Tigran Sergeyevich Khachaturov by correspondent of EKONOMICHESKAYA GAZETA; date and place not specified]

[Text] [Question] What tasks face the Scientific-Economic Society?

[Answer] The Scientific-Economic Society, as a volunteer mass organization of economic society has been called upon to cooperate in light of the economic policies of the CPSU in the effective organization of economic activity in the national economy, development of economic science, and use of its achievements in economic practice.

The activity of the society will be aimed at all possible development of creative initiative and activity of economists in working out questions of improving the economic mechanism, improving the efficiency of production based on its all possible intensification. Thus, specific questions of improving planning, control, rise in labor productivity, fund-output can be successfully solved by the participation of the public on the scales of the sector, oblast, and individual economic units. Economic practitioners and scientists can provide a lot of help in the use of reserves of conservation of material resources.

The Scientific-Economic Society is faced with the task of extensively involving workers of state institutions and economic services, and specialists in scientific-economic creativity, development of public forms of participation of specialists and scientific workers in solving the problems of intensifying production and improving its efficiency.

An important task of the society is to strengthen creative cooperation of the workers of science and production. Finally, the society must conduct broad propaganda of the achievements of economic science, the leading experience, economic knowledge, and promote the economic education and upbringing of the workers. It is also suggested that it develop ties with economic societies of foreign countries, and participate in the activity of international organizations. Specific tasks of the new society will be defined in its charter which will be adopted at the first congress.

[Question] Who can be a member of the society and how will its primary organizations be set up?

[Answer] Scientists, engineering-technical workers, economists and other specialists of planning, financial, statistical institutions and agencies of material-technical supply, scientist-economists, colleagues of scientific-research institutes, VUZ's and technical schools, workers of other organizations and enterprises of the national economy can become active members of the Scientific-Economic Society.

Organizations and institutions of planning-financial, statistical and other agencies can participate in the Scientific-Economic Society as its juridical members.

The organizational office appealed to the USSR Gosplan, the USSR Ministry of Finances, the USSR Stroybank, the USSR Gossnab, the USSR Gosbank, the USSR Central Statistical Administration to cooperate in setting up local organizations of the Scientific-Economic Society, help departmental organizations and institutions become juridical members of the society, and also assist in providing the necessary service rules.

The republic, kray, oblast, Moscow and Kiev city committees of the trade union of workers of state institutions and local councils of the Scientific and Technical Society by agreement with the organizational office should form organizational offices for holding elections for councils of primary organizations and boards of the Scientific-Economic Society in the republics, krays, oblasts and cities of Moscow and Kiev.

[Question] What sections will be created in the Scientific-Economic Society?

[Answer] The following sections were defined in preliminary order at the meeting of the organizational office: political economy, planning of the national economy, economics of material-technical supply, finances and credit, economics of labor and labor resources, organization and control of social production, statistics, calculation and analysis of economic activity, economics of the use of nature, economics of scientific-technical progress, economic education and training of cadres, economic-mathematical methods, arrangement of productive forces, economics of the nonproduction sphere, prices and price formation, efficiency of capital investments.

Of course, life will dictate the expediency of certain refinements of this list. It is most important that the organization of the sections promote to the maximum the unification and development of creative self activity of the members of the society of one specialty.

[Question] What can you say about the forms of work of the society?

[Answer] All the documents of the All-Union Council of the Scientific and Technical Society which defined the activity of scientific-technical societies extend to the Scientific-Economic Society. The All-Union Council of the Scientific and Technical Society unites 24 scientific-technical societies set up on the sector principle. A number of them have over 9.8 million people. All that is valuable

from the accumulated work experience, especially of the economic sections, for the development of creative activity of scientists and specialists of course needs to be completely utilized. This means conducting of scientific-economic meetings, conferences, reviews, competitions, seminars, measures for improving the level of economic knowledge, preparation and realization of suggestions and recommendations.

[Question] What questions will be discussed at the first congress of the society and when is it planned to be held?

[Answer] The congress will adopt the charter, select the leading agencies of the society, solve organizational questions, discuss the path for improving the role of the society in economic practice, scientific life, propaganda of economic knowledge, and the leading experience of management. All the organizational work to set up the Scientific-Economic Society, including holding of the congress, should be completed before the end of the year, by the next imminent all-union congress of Scientific-Technical Society.

9035
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INTERDEPARTMENTAL COORDINATING COUNCIL HOLDS CONFERENCE IN LENINGRAD

Leningrad LENINGRADSKAYA PRAVDA in Russian 3 Feb 82 p 3

[Article from LenTASS: "Science of Leningrad for the Five-Year Plan"]

[Text] The Interdepartmental Coordinating Council (ICC) of the USSR Academy of Sciences has become the "brain center" uniting the efforts of the Leningrad academic institutions, VUZ's, 300 sector research institutes and design offices, and almost 200 leading industrial associations of the city. Tens of thousands of scientists and specialists here are solving basic and applied tasks in frontal trends of modern scientific and technical progress. The range of research and development of the Leningrad scientists encompasses 49 major scientific and technical programs of national importance. Twenty of them treat problems of power engineering and the country's fuel and energy complex.

The state and outlook for work of the Interdepartmental Coordinating Council in the Leningrad region according to the national scientific and technical programs stipulated by the decisions of the 26th CPSU Congress are being discussed at an expanded meeting of the council office which opened yesterday.

The first day of the meeting heard reports of the chairmen and members of the specialized scientific councils. Academician M. M. Shults reported certain results of work of the Leningrad chemists. Corresponding member of the USSR Academy of Sciences I. V. Gurynin dedicated his speech to urgent physical metallurgy problems of modern reactor construction. Professor A. K. Grigor'yev related the development by the Leningrad organization of advanced technology of power metallurgy and composite materials. The chairman of the ICC, representative of the presidium of the USSR Academy of Sciences for Leningrad, Hero of Socialist Labor, Academician I. A. Glevav dedicated his speech to the creation of new types of electrical engineering equipment using superconductance phenomena. Corresponding member of the USSR Academy of Sciences A. A. Vavilov reported on the basic trends in development of scientific research work in the area of robot engineering, activation in control processes. Other Leningrad scientists and specialists, and leaders of research collectives reported on their work.

The meeting participates visited the All-Union Scientific Research and Planning Institute of the Aluminum, Magnesium and Electrode Industry (VAMI) where they became familiar with the development of new methods of aluminum production.

The president of the USSR Academy of Sciences, 3-time Hero of Socialist Labor A. P. Aleksandrov spoke at the meeting.

Secretary of the Leningrad CPSU Obkom V. G. Zakharov participated in the meeting's work.

Today the expanded meeting of the Interdepartmental Coordinating Council office of the USSR Academy of Sciences continues its work in Leningrad.

9035
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NOVOSIBIRSK OBKOM COUNCIL COORDINATES S&T, SOCIO-ECONOMIC DEVELOPMENT

Moscow EKONOMICHESKAYA GAZETA in Russian No 10, Mar 82 p 5

[Article by I. A. Mironov, secretary of the Novosibirsk CPSU obkom: "Scientific-Technical Potential: Efficient Use"]

[Text] Integration of science and production, and acceleration of realization of scientific achievements in practice are one of the main levers for scientific and technical progress and the intensive development of our country's economy. The 26th CPSU Congress noted the positive experience of solving these tasks in our oblast party organization.

The Novosibirskaya Oblast is one of the major industrial and agricultural centers of Siberia and the Russian Federation. At the same time, considerable scientific-technical forces are concentrated here which are capable of guaranteeing both basic research, and applied: the Novosibirsk scientific center of the Siberian Department of the USSR Academy of Sciences, Siberian Department of the VASKhNIL [All-Union Order of Lenin Academy of Agricultural Sciences imeni V. I. Lenin], and the USSR Academy of Medical Sciences, over 100 sector scientific research institutes and planning organizations, and departments of scientific-technical and technological profile of 16 VUZ's.

Interaction of Forces

The five-year and long-term contracts for cooperation between scientists of the Siberian Department of the USSR Academy of Sciences and Industrial Enterprises and Production Associations of the City, the aviation plant imeni Chkalov, "Sibsel'mash," "Sibelektroterm," the construction administration "Sibakademstroy," the sovkhozes "Iskitimskiy," and "Shuryginskiy" have undoubtedly brought enormous benefit. In the future we will maintain the initiatives. Here direct outlets from the plants to the sectors have already been strengthened, at the junction of the sectors.

Nevertheless coordination on oblast scales was necessary. The fact is that sector affiliation of the enterprises did not make it possible to have a specific knowledge of which of the scientific developments can be classified as a stockpile for introduction today, tomorrow, or the day after tomorrow (the calculation of course is made for years and five-years). Which sector is ready to adopt a certain suggestion and can the intersector barrier be avoided? Finally, what do

the enterprises need, where to concentrate scientific-technical and production forces?

The experience of interaction of scientific forces and practice has been developed over the years. However, the oblast party organization has been continually disturbed by the question of: how to coordinate better these forces, direct them towards solving the most important problems of intensifying production? How can a precise system of introduction into production of scientific developments be made?

The solution to these questions was entrusted to the council to coordinate the development of scientific-technical and social-economic development of the oblast set up two years ago in the party obkom.

Coordinating Role of the Council

Long before the creation of the council, we tried to find out what we have. We had in mind both the developments of progressive technology by the institutes of the Siberian Department of the USSR Academy of Sciences, and the sector scientific research institutes and design offices, departments of VUZ's, regardless of their departmental affiliation. Thus a list was born and analysis was made of specific developments which passed production verification and which could be introduced.

The coordination council was interested in taking into consideration in the best manner the interests of production, and clarifying what our enterprises and construction projects expect from science.

Sector and problem sections were set up in the council: labor resources, ACS [automated control system] and computer equipment, machine construction and metal working, power engineering, electronics and instrument making, transportation, and construction. Within the framework of the section, the work was set up so that no departmental barriers interfered with solving problems as a whole.

The presidium of the coordination council supervises the work. It examines the programs, and monitors their fulfillment. At the suggestion of the presidium, the most important questions are transferred for examination to the office of the oblast party committee and presented to the scientific-practical conferences.

One of the chief requirements that guides the council is the search for internal reserves solving the most acute problems of the oblast. That is, success must be attained not through involvement of additional material and labor resources, but through the leading scientific-technical solutions, new technology, high level of control and organization of work, and socialist competition.

Program-Target Approach

Work is mainly set up according to the following principle: the head organization is first defined according to the outlined problem. It develops a draft for a target program. Then the draft (this is generally the variant which is

then improved many times) is discussed at the section meeting. Only when the program adopts its final forms and features is it presented to the meeting of the council presidium. We will present several examples.

The section of machine construction and metal working of the coordination council prepared a regional program "Robotization of Industry." The coordination of the activity of the organization and co-executor enterprises, in particular, to develop and to manufacture the mechanical part of the robots in the Novosibirskaya Oblast is an important problem. The robots can be completed with unified systems of program control. Primary attention in the program is focused on technologies of labor-saving nature.

Thus, a year ago at the Novosibirsk plant of precision machine construction, the first robot complex was started up. It is used for extruding rubber ring drive belts for tape recorders. The introduction of a mechanical arm created conditions for maintenance by the workers of three presses (previously one). Today the robot complexes perform heavy physical work. The plant collective in the socialist commitments for the current five-year plan have planned to introduce another 38 robot complexes. About 30 of them will work in the stamping production.

The program-target approach made it possible to specify all the activity for robotization of production at enterprises of Novosibirsk both by years and in the 11th Five-Year Plan as a whole. The target program stipulates introduction of over 500 automatic manipulators. In this year alone, for example, their number will be increased at the plants "Sibelektrotyazhmash," the aviation plant imeni Chkalov, instrument making plant imeni Lenin. It is also proposed that robotized sections be sent up. The final targets have been defined: by introducing robots and manipulators over 600 workers will be released, and by the end of the five-year plan, no less than R 4 million will be obtained.

Here is another example. Now there is total confidence that in the 11th Five-Year Plan, ash from the central heating and power plant, and not only lignite, but also coal ash, will be widely used in construction industry of the oblast. The coordination council has united the interests of builders and power engineers which help to solve the problem which not only has great economic, but also social and environmental protection importance.

Practice has suggested many topics for science. A characteristic example here is the programs developed in the section "construction." They stipulate a set of work to introduce new materials based on the use of wastes, broad application of polymers, highly productive machines and mechanisms to work the ground, drive in pilings and columns, trenchless laying of pipes, as well as the introduction of leading technological procedures such as electrochemical treatment of water, stamping of parts made of band steel. Eight topics are being fulfilled by the scientific research institutes at suggestions of the builders. The coordination council has helped them "to be written into" the plans of scientific research and experimental design work of the institutes and design offices.

Now work is successfully underway in many programs. This concerns such questions as labor and labor resources, health of the oblast population, introduction of

robot machines at our enterprises. There is a coordination group which is active for each program. They include representatives of all the executor organizations. At least once a year the course of fulfillment of the program is discussed at a meeting of the coordinating council presidium.

Of course, life does not stand still, and even the approved programs often undergo changes. New solutions appear, experience is accumulated, and the viewpoint changes. For example, we initially had four programs for power engineering. Now only two remain, for heat supply and electricity supply. It has become necessary to form new sections, if only on questions of standardization and quality.

Educational Aspects

Among the results of its work during the two years, the coordination council has right to include the confidence that departmental barriers have been completely overcome in constant support and rigorous monitoring on the part of the party and soviet agencies. Many leaders of enterprises and institutes have acquired this confidence in their practical work. Only the first steps have been taken, but the steps themselves are important. They have indicated how great our reserves and potentialities are, and how much can be done with unification of forces.

One should stress here the educational function of the coordination council. Even in a first examination of the problems, we see that many of our misfortunes are the result of poor management, lack of ability to manage what we have, inability of individual leaders to look to tomorrow and see the future. An exacting and party analysis educates the cadres. Comprehensive discussion of problems by specialists in different departments, unified by a common interest, makes it possible to adopt the optimal decisions, to find ways to accelerate scientific and technical progress, and to break the habit of the order of seniority.

For a successful resolution of the tasks before the council, their fundamental economic reworking is needed. We place great hopes on the Novosibirsk economic laboratory set up at the request of the CPSU obkom in the Institute of Economics and Organization of Industrial Production of the Siberian Department of the USSR Academy of Sciences. In cooperation with the institute of the national economy, the oblast plan and the city plan, and other organizations, it will help to develop the basic trends for scientific-technical and social-economic development of Novosibirsk and the oblast up to the year 1990.

Concentration of forces on the main directions will permit more complete utilization of the scientific-production potential, guarantee harmonious development of all sectors of the economy, and confidently fulfill the planned assignments for the five-year plan.

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CSO: 1814/64

ACADEMICIAN MARCHUK STRESSES INTENSIVE ECONOMIC DEVELOPMENT

Moscow APN DAILY REVIEW in English 6 May 82 pp 1-5

[Article by Academician G. Marchuk, deputy-chairman of the USSR Council of Ministers and chairman of the State Committee of the USSR for Science and Technology: "Landmarks of Progress"]

[Summary] One of the characteristics of our times is the growing influence of science on society. This is illustrated with special force in the economy, where scientific achievements form the groundwork on which to retool and raise production efficiency, increase labour productivity and efficiency, improve quality, and make rational use of energy, material and manpower resources. The renowned Leninist thesis on science as an immediate productive force is being translated into reality before our eyes. Correspondingly, its role having grown, science now bears an immeasurably greater responsibility towards society.

"The conditions under which the national economy will be developing in the 80s make the acceleration of scientific and technological progress ever more pressing," Leonid Brezhnev said at the 26th Congress of the Communist Party of the Soviet Union. Behind these words is the priority task of providing the country with the technology, materials and instruments to ensure the economy's transition to intensive development, to raising efficiency and quality in all areas of our endeavour, and to making our economy truly economical.

170 interindustrial scientific-technical programmes prepared by the State Committee of the USSR for Science and Technology jointly with the Academy of Sciences of the USSR and the State Planning Committee of the USSR are oriented towards this goal. For the most part they are to ensure higher production efficiency and the saving of power, material and labour resources in all the key industries--power generation, metallurgy, chemistry, construction, transportation, and agriculture. As distinct from the practice of the last five-year plan period, these programmes provide not only for the time limits of the creation and mastering of new technology, but also for its being put to use year by year. According to preliminary estimates, upwards of 4,000 types of new machines and technologies, about 60 per cent of which are planned to be put to use in the current five-year period, will be created under the programmes.

Of these programmes about 20 are immediately associated with the effort to resolve the food problem. For example, to raise the efficiency of the agro-industrial complex, more than 300 highly efficient agricultural machines and types of equipment will be built and put into service. Production will start of new and highly concentrated mineral fertilisers with a prolonged action and an improved nutritive balance. The livestock-breeding complexes now account for the bulk of meat and dairy output. For these complexes, equipment will be built to mechanise almost 40 operations which are still performed manually.

During 1981, the first year of the current five-year plan period, work was completed on nearly 4,000 goals and stages of the current scientific-technical programmes. In all, 602 new types of industrial products were put into serial production that year, 133 new production processes were introduced, 2,199 transfer lines were put into service, and 983 shops and industries introduced comprehensive mechanisation and automation in production. As many as 294 automated management systems came on line.

Summing up, I can say with confidence that a lot was done during the first year of the current five-year period. Representatives of all the Soviet Republics, as shown by the results of the 1981 all-Union socialist competition, shared in this work.

The prizes awarded by the Council of Ministers of the USSR in 1982 attest to the great headway made by Soviet science and technology and to the high efficiency of their practical application. On the recommendation of the State Committee of the USSR for Science and Technology and the All-Union Central Council of Trade Unions, these prizes are awarded on Soviet Science Day for comprehensive research, for research and design, and for technological studies in key areas of the economy and for their production uses.

Among the latest winners of the prizes given by the Council of Ministers of the USSR is a large group of specialists in industry, scientists, and innovators who have developed principles of steel alloying in casting and the technology of casting parts for railway cars and mining and smelting equipment. The high technological level of this comprehensive study is proved by the fact that 76 Author's Certificates have been issued for the new alloys, alloying technologies and the economical alloy components. The new steel alloys extend 1.2-2 times the service life of the parts of the mining and smelting equipment. Their use in building transportation equipment has raised railway cars' load-carrying capacity from 64 to 70 tons and the train's weight from 6,000 to 8,000 tons.

Jointly with machine-builders, the steel-makers have developed and mastered on a broad scale and the technology of making new types of electric-welded, cold-shot and special-shape pipes. This important job required thorough research, new methods of pipe-framing, new mills for making thin-walled pipe of two metal strips, new high-frequency welding units and equipment for removing longitudinal welding flash. New pipes have found their way into agricultural machine-building, electrical engineering, the automobile and food industries, ship-building, bicycle manufacturing and furniture-making. The use of these pipes save about 42 million rubles annually.

Many of the prize-winning works are associated with solving the all-important problem of eliminating hard manual labour. For example, specialists from organisations and factories under the Ministry of Machine-Tool Construction have developed and put into serial production efficient chill mold machines, injection molding machines and automated complexes which use this equipment as their basis. As a result, seven automobile and tractor factories now have fully mechanised and automated shops producing sophisticated thin-walled and exacting aluminum castings such as block-cast cylinders. In these shops productivity has grown 1.9-2 times, working conditions have improved and the work of 800 workers has been saved. Really, there is a good reason why 47 Author's Certificates and patents were issued for this work.

Arduous manual operations have been eliminated by the highly efficient plasma-cutting technology, programme-controlled by the Kristal computers and the Takt coordinatorgraph, which supervises the control programmes. Their use at factories has raised the accuracy of cutting 4-5 times, which has in turn lowered labour expenditures for their adjustment and has made it possible to mechanise and automate the assembly and welding operations. As a result, labour productivity has summarily grown 3-5 times.

To make work easier and more efficient was the goal pursued by the other prize-winners - specialists from the ministries of ship-building, the merchant marine, and heavy machine-building. They have built and mastered the use of general purpose ships carrying containers, packaged timber, automobiles and other wheeled machinery. These vessels are outfitted with fundamentally new equipment for the fast handling of materials. In combination with their high performance, this makes them indispensable for use in the Far East and in ports which allow little mooring room.

A feature of our time is the extensive use of computers in coping with problems of economic planning, organisation and management. Efficient efforts have been made in this area, as proved by the prize-winning comprehensive system of production management and of material and financial resource management, created by specialists from the Ministry of Instrument-Making along with the Siberian branch of the Academy of Sciences of the USSR. The system ensures the annual saving of over 13 million rubles. Nearly as much (10 million) a year is saved by the automated prognostication system of passenger traffic, built by the Ministry of Civil Aviation. The system is employed in drawing up air traffic and maintenance plans and flight schedules.

Many of the works which have won prizes from the Council of Ministers of the USSR are distinguished not only by their high technology but also by their originality. Among them is a gamut of casing-head gas collectors. Both simple in design and compact, they reduce to a quarter the time it takes to put a project into operation and they cut capital expenses 1.5-2 times and operating expenses 10 times. Their design is protected by 11 Author's Certificates and patents in 6 countries, including Britain, the USA and West Germany.

Another original solution is offered in the design of the KGK-100 complex for drilling geological wells down to 100 metres. Due to the pipe-in-pipe

design of the drilling column it continuously sends core samples to the surface. Drilling fluid is pumped in between the pipe walls. It pushes out the core samples from the central canal of the inner pipe, thus raising the speed of drilling 2-3 times and reducing its cost by 2.5 times.

The other prize-winning works will also greatly benefit the national economy.

CSO: 1814/108-E

NEW LENIN PRIZE LAUREATES

Moscow APN DAILY REVIEW in English 22 Apr 82 pp 1-2

[Article entitled: "New Laureates of the Lenin Prize"]

[Text] The CPSU Central Committee and the USSR Council of Ministers awarded the Lenin Prizes of 1982 in the sphere of science and technology. Among those to whom this prize was awarded are authors of five major works of research in the sphere of physics, biology, geology, medicine and optics.

At the top of the list are the authors of the project in the sphere of high-energy and cosmic-ray physics. The work has been carried out by the collectives of two institutes, a Moscow institute and a Yakutian institute, so among the authors are scientists of several nationalities, specifically, Russians and Yakuts. The use of unique equipment of the Yakutian Institute of Cosmic Physics Research enabled specilists to determine the energy spectrum and the composition of cosmic radiation.

In the sphere of biology the Lenin Prize was awarded to Academician Sergei Severin who devoted his research to fermentative processes of muscles. His work is of theoretical and practical importance. The scientist isolated a number of new ferments that have medicinal effect in their pure form.

The work of Academician Yevgeny Sergeyev "Engineering Geology of the USSR" has become a major contribution to geology. He has also been awarded the Prize. The work contains description of engineering and geological conditions of the vast territory of the USSR. This is the first such work. The eight volumes contain the description of the property of rock, contemporary geological processes, sum up the experience of construction and its effect on the geological medium.

The Lenin Prize was awarded to Soviet medic, Academician Yevgeny Chazov who suggested principally new methods of treating cardio-vascular diseases with the use of ferment preparations. Clinical observation of patients with myocardiac infarction showed the effectivity of Chazov's original approach to the treatment of serious diseases. His methods, specifically, decreased allergic, toxic and other side-effects that develop in patients with vascular diseases.

The Lenin Prize was earned by a large collective working under the supervision of Professor Mikhail Rusinov. They were awarded the prize for creating specialized wide-angle optical instruments with the use of which the mapping of the territory of the USSR and a number of other countries was made. Photographs made from space with the use of new optical instruments were used in geology, meteorology, agriculture and forestry, land reclamation and other spheres of the national economy.

CSO: 1814/108-E

ACADEMICIAN OVCHINNIKOV OUTLINES SOVIET ACHIEVEMENTS

Moscow APN DAILY REVIEW in English 7 May 82 pp 1-7

[Article entitled: "New Frontiers of Progress"]

[Summary] Academician Y. A. Ovchinnikov has quickly made a splendid career in science. A tall youth from Krasnoyarsk, he was the best student of his department from the first year of studies. A few years after graduation from Moscow University he received his M.Sc. degree and, almost immediately after that, his D.Sc. degree. At thirty he was elected Corresponding Member and at 36 Full Member of the USSR Academy of Sciences. At 39 he became the Academy's youngest ever Vice-President with special responsibility for chemistry, biology, biochemistry, physiology and medicine.

Below is an interview Y. A. Ovchinnikov, Hero of Socialist Labour, gave to Trud special correspondent I. Melenevsky.

* * *

Question: Will you kindly tell us something about the achievements of Soviet scientists?

Answer: They can be found in all fields, in the humanities, particularly in the social science, and in the natural science, in physics, chemistry, biology, and the terrestrial sciences.

Soviet physicists have done much in the study of interaction between elementary particles, especially between electrons and protons at high energies. These processes are studied by means of modern accelerators in Serpukhov, Dubna and Novosibirsk. These projects help us understand the microworld and discover new laws governing the interaction and existence of these particles. I think that these projects are paving the way to the power industry of the future that will be probably based on controlled thermonuclear synthesis.

Soviet chemists have developed many unique materials. In this connection I want to emphasise extra-pure substances which are of crucial importance for electronics and some other specialist sectors. The staff of the Institute of Chemistry in Gorky has evolved a multistage crystallisation method to

receive extra-pure substances. Also, of late we have received a number of new materials important for the industry, particularly filled polymers and composites. A new sector of science has emerged which makes it possible to produce substances of increased stability, unprecidented strength and high resistance to corrosion. On the basis of polyamid fibres Soviet scientists have developed polymers which are stronger than steel and many other metals.

Question: Your name is frequently associated with the development of bioengineering. Could you describe in brief this sector of science?

Answer: Broadly speaking, the term bioengineering means that biology has embarked upon the road of transformation and industrial development. Our scientists are learning to control life for the sake of life. Bioengineering allows us to receive energy from biological sources, particularly to use renewable vegetable raw materials to obtain natural gas. Bioengineering is closely connected with the rational utilisation and protection of the environment. Today it is a very important problem not only for big cities with numerous industrial enterprises. Take, for example, the tundra which develops according to its own biological laws and whose nature is very vulnerable to external influences. The case at hand is the construction of the Baikal-Amur Railway. When new mineral deposits, say, oil, are being developed in the northern parts of the country, it is necessary to take into account ecological factors and study them in full earnest. Bioengineering plays the role of tremendous importance in this respect, since microorganisms assimilate everything and can process all that is harmful to man into useful things. They are extremely productive and voracious and utilise all waste of the economic activity of man. Today microorganisms are the most effective and promising source of processing different substances.

Another sensational aspect of biotechnology is that we can modify some organisms, first of all, microorganisms, bacteria, and viruses in the desired direction. This opens up the possibility to use these microoganisms to receive physiologically active substances, particularly proteins extremely necessary for the human organism, or hormones, especially insulin, or protective substances, such as interferon. This method can also be used to produce substances regulating the activities of the nervous system of man, neuroproteins found in the brain of man, etc. It is impossible to receive them by other methods with the exception of bioengineering, specifically genetic or cellular engineering. Nowadays the genetic apparatus of bacteria with a built-in gene of man or animal functions confidently enough. The ability to control genetic apparatuses is a tremendous achievement of the science concerned with the vital activity of organisms. The same applies to the cell. Cells can be united or fused to receive new ones. This should be done in accordance with laws which usually do not reveal themselves in nature, that is, to combine, in accordance with our aim, cells which do not form hybrides in nature. This method is effective for developing entirely new species of animals and plants.

The cell can also be employed to receive the biomass of one or another material. Suppose that it is necessary to receive a valuable product from a medicinal plant. Today the only way to do this is to sow a large area to

such plants, which is inconvenient, expensive and requires much time. Bio-engineering suggests another solution. It is possible to grow the biomass of this plant in an industrial unit and receive the physiologically active elements of medicinal plants. At present this method is effectively used for the large-scale production of the compounds of ginseng and other plants which have a stimulating or tranquilising effect on the human organism.

Question: The USSR Academy of Sciences arranges joint sessions with sectoral academies. What can you say about this new form of cooperation in science?

Answer: We held joint sessions with the USSR Academies of medical and agricultural sciences. I want to stress that our cooperation is not reduced to joint sessions. We have established the Learned Council on the Basic Principles of Medicine to direct day-to-day work in this field. Headed by A. P. Alexandrov, President of the USSR Academy of Sciences, the Council includes leading medical authorities, particularly the USSR Minister of Public Health. We meet regularly, usually once every three months, to discuss specific medical issues.

Question: Can we speak about the practical results of this cooperation? Take cancer, for example. Are scientists close to winning over this disease?

Answer: Today's understanding of the problem of cancer differs radically from the idea we had ten years ago. In the past we did not know how cancer originated and it was not known how to combat it. Today we have established the nature of cancer. It has been established beyond doubt that this is a viral-genetic disease, i.e., the genetic apparatus of man is responsible for its outbreak and the predisposition of some people to it. The mechanism which leads to cancer may become switched on at a certain time or it may never become activated.

How is this process regulated? What can we do in this field? We have a goal-oriented programme which we recently discussed in the Council. We called it Programme Oncogen, after the gene responsible for cancer. The time when mankind will be able to subdue cancer is not far off and it is coming nearer very quickly. I think that we shall be able to shape practical recommendations to fight cancer on the basis of the study of this disease as a biological phenomenon in 10 or 15 years hence. I consider that this is feasible.

A lot of data show that interferon can be effectively used against virus-caused cancers. Interferon, a natural anti-viral substance, can kill the virus of cancer. Thus, all cases of herpes, a simple viral cancer, are effectively treated by means of interferon. There are also other methods, but we are working on them.

Question: Rumours about psychics and the sensational results of their treatment do not abate. What do you think about the effectiveness of the "biological field"?

Answer: The specificities of human individuals constitute one of the most complicated aspects of modern biology. Strictly speaking, biology has not yet taken up such questions. Intricate and highly complicated mechanisms stand behind the outstanding abilities of man. I am sure that people with unique abilities exist. It is not important how we call them, psychics or extremely sensitive people. The main thing is that they exist and this is an objective fact. I think that such phenomena should be studied with the help of all scientific methods.

Unfortunately, such phenomena are sometimes used to formulate unconvincing theories or premature conclusions. At present science cannot confirm the existence of any special biological field. We know many things about the material world that surrounds us. We know that man has a physical field. Incidentally, he also has a chemical field. However, some enigmatic, magic meaning is attached to the biological field. I don't think it is correct, because such interpretation confuses people who begin to view the relevant phenomena as something that cannot be cognised, as something miraculous or magic. I think that it is necessary to study problems connected with the unusual, unique abilities of people. The generalisations which are made by some persons today are untenable from the scientific point of view.

Question: What basically new contributions are chemists and biologists preparing to make to the fulfillment of the food problem?

Answer: Nowadays we can effectively control the development of plants. Some plants, particularly reeds and alder, easily assimilate nitrogen. How do they do this? Although we have not yet received completely reliable data, I think that certain microorganisms are responsible for the assimilation of nitrogen. Why are they capable of assimilating nitrogen? What kind of enzyme systems do they use to turn nitrogen into the complexes of substances that are easily assimilated by the organism? Nitrogen is inert. Inertness is the main obstacle to its assimilation. It has been found out that the genetic apparatus contains a range of proteins, and consequently, a range of genes responsible for nitrogen fixation. Scientists want to transplant this apparatus into another microorganism or directly into a plant. If we succeeded in feeding wheat with nitrogen with the aid of its own genetic apparatus, the problem of nitrogen fertilizers would become less acute and, of course, this would mean a revolution in agriculture. We are working to raise the ability of a number of plants to assimilate nitrogen.

Some projects have a pioneering character. Thus, one of them concerns the production of proteins from non-traditional sources. The world's oceans are an especially promising object of searches. Take, for example, the krill, a tiny crayfish which lives in the ocean and contains almost unlimited resources of protein. However, the krill must be processed so that it can be digested by animals and man. We are intensively tackling this problem and I think that prospects are good.

Scientists also concentrate on soil fertility. Thus, the Institute of Radio Engineering and Electronics, headed by Academician V. A. Kotelnikov, has evolved a method to monitor soil humidity by means of infrared spectroscopy. Installed on board an aircraft, a spectroscope can yield precise information

about soil humidity during one flight over a big field. Such information is extremely important for harvest forecasting.

Question: Suppose that scientists solved the more important problems at the end of the 20th century and at the beginning of the 21st century. What problems can it concern in particular? How will science develop after that?

Answer: I shall enumerate several problems of this type. I shall begin with biology. I am confident that we shall begin to fight cancer successfully. It will disappear as small-pox did in its time. Now about power. Semi-industrial thermonuclear units will be developed and we shall immediately feel their effect as they will eliminate the shortage of fuel and energy. I think these units will be developed on the basis of our Tokamak facility, ordinary or super-conducting, or will depend on the laser triggering of thermonuclear reactions, or on some other principles. Mankind will receive a new tremendous source of energy. We shall probably develop very effective methods to receive liquid fuel not from oil but from vegetable products, particularly from coal.

Computing technology will make big headway. We shall develop super-capacious integral circuits with the density of elements exceeding that of today's circuits by several orders. As a result, quantity-produced instruments will become convenient and very small. I think of a thimble-sized TV set which will be very convenient for some experiments. It will be possible to develop electronic units small enough to be put in a telephone or in an ordinary radio. Today the units of this class require big buildings.

I am certain that the development of such computing technology will make accurate and long-term weather forecast possible. I don't think that we shall learn to control climate and maybe this is not necessary. However, we must know weather in advance because such information would settle many problems in agriculture.

I think that during this period science will make it clear, to politicians in the first place, that war should be excluded from the life of mankind, because scientific achievements will be so tremendous that their use for the creation of mass destruction weapons will lead to global catastrophes. I do not doubt that eventually all achievements of science will be used for the good of mankind.

(TRUD, 17 Apr 82. Abridged.)

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SIBERIAN ACADEMY OF SCIENCES CELEBRATES 25TH ANNIVERSARY

Moscow APN DAILY REVIEW in English 18 May 82 pp 1-3

[Article by Academician D. Belyayev, deputy chairman of the Siberian Department, USSR Academy of Sciences, director of the Institute of Cytology and Genetics: "High Scientific Potential"]

[Summary] The Communist Party and the Soviet government have always displayed great concern for the development of science, regarding it as the foundation for the further economic and cultural progress of the nation. A vivid manifestation of this is the decision, passed by the USSR Council of Ministers 25 years ago, to establish a Siberian Department of the USSR Academy of Sciences.

Science has been developing rapidly in Siberia in the past quarter of the century. The larger Novosibirsk scientific centre now has the East Siberian, Yakut, Buryat, the Krasnoyarsk and Tomsk branches which operate as amalgamations of research institutions, design offices and experimental plants. The Siberian Department consists of nearly 60 research institutes and design offices, employing 23 full members and 54 corresponding members of the USSR Academy of Sciences, more than 450 doctors of sciences and nearly 4,000 masters of sciences. This team can cope with any major problems put forward by science and life.

It has always been the main task of the Siberian Department to raise the efficiency of basic and applied research.

Institutes concerned with mathematics and physics have solved a number of major macroeconomic problems in the past 25 years. In particular, they developed and introduced the methods of welding different metals, fundamentally new technologies for the stamping and hardening of components, and efficient automated systems of production and technological control. Strong-current industrial particles accelerators, developed in Siberia, are extensively used in the Soviet economy.

Chemical institutes also have major projects to their credit. They evolved new methods and technologies, particularly those relying on new catalysts, which produced a revolutionising impact on the chemical industry.

Geological institutes have carried out a great deal of work. Geologists developed basically new methods and technologies for mineral exploration, particularly for oil exploration. They help discover new mineral deposits. Geologists studied laws governing the structure of the terrestrial crust, particularly the Baikal rift system, and established some major specificities of seismicity.

Siberia's minerals and other crude products are increasingly becoming the foundation for the development of the Soviet economy as a whole. The economists of the Siberian Department made a great contribution to the long-range planning of the development of Siberia's productive forces. The results of their projects are extensively used by national planning agencies.

The study and rational utilisation of Siberia's natural resources and the protection of nature will always remain a major concern of the Siberian scientists. For a long time practically all the institutes of the Siberian Department collaborated in producing integrated Programme Siberia, the aim of which is the development of Siberia's productive forces. This federal programme provides for the faster development of the country on the basis of the integrated use of Siberia's natural resources. Over 400 research institutes participate in implementing this programme which includes tens of sub-programmes. Besides the institutes of the Siberian Department, taking part in this work are the research sections of the Siberian Department of the USSR Academy of Agricultural Sciences, the Siberian Department of the USSR Academy of Medical Sciences, and sectoral institutes.

On May 4, 1982, the Presidium of the USSR Supreme Soviet awarded the Order of Lenin to the Siberian Department for successful research projects, the training of highly skilled scientific personnel and a great contribution to the development of the Siberian productive forces. All Siberian scientists met reports about the high award with great enthusiasm. The scientists, technologists and workers employed by the Siberian Department understand that the high award makes them duty bound to raise the efficiency of research and use research results to accelerate the scientific and technical progress of the Soviet economy.

Novosibirsk,

(TRUD, 18 May 82. Abridged)

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SOVIET SCIENTISTS SUM UP RESULTS OF PAST YEAR

Moscow APN DAILY REVIEW in English 4 Mar 82 pp 1-2

[Text] In the past year the Academy of Sciences of the USSR concentrated its efforts on problems of paramount importance for the national economy and on questions concerning a maximum use of scientific achievements in production, Anatoly Alexandrov, the President of the Academy of Sciences said when opening the traditional annual assembly of this scientific organization on March 3.

The president noted the successes scored by Soviet scientists in the exploration of outer space, in engineering and instrument-making, in the fields of chemistry and power engineering. In 1981, Soviet industry put to use 230 recommendations of scientists of the Academy of Sciences, said Georgy Skryabin, the Chief academic secretary. Much attention was given to powder metallurgy, glass light-guides which replace traditional communication lines, MHD-generators and lasers. A long-term programme for the development of power engineering has been drawn up.

The cooperation of Soviet scientists with their colleagues in socialist countries has been broadened and deepened. The scientist said that in the past year joint investigations covered 1,600 themes.

The Academy's relations with scientific institutions in capitalist countries have been affected by a general complication of the international situation, Academician Skryabin said. Thus, the U.S. Administration has reduced to a minimum contacts under intergovernmental agreements with the Soviet Union on problems of science and technology.

Academician Skryabin recalled that despite the restraint shown by the administration of the National Academy of Sciences of the USA in respect of development of ties with the Soviet Academy of Sciences, the American side suggested holding on a regular basis meetings of scientists of the two academies to discuss problems of international security and arms control. The Soviet Academy accepted this proposal. Two meetings have already been held. They were positively assessed by both sides.

"There have been so far no sign of a turn for the better in Soviet-American scientific links. Moreover, the actions taken lately by the American Administration towards Soviet scientists create more obstacles to this."

There has been a steady development of relations between Soviet scientists and their colleagues in West Germany, Italy, France and Finland. Relations with British scientists have become more active. The academy's agreements with scientific organizations in Spain, Sweden, Afghanistan, Algeria, Venezuela, Syria and other countries have been put into effect, Skryabin said. 3,200 Soviet scientists made trips to capitalist and developing countries during the year and approximately as many foreign guests from these countries were received in the Soviet Union. The USSR Academy of Sciences is a member of 183 international organizations.

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ACADEMICIAN AMBARTSUMYAN REPORTS ON ARMENIAN SCIENTIFIC ACTIVITIES

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 4 Mar 82 p 4

[Article by Academician V. Ambartsumyan, two-time Hero of Socialist Labor, president of the Armenian SSR Academy of Sciences: "Union of Theory and Practice"]

[Text] Sometimes a simple comparison helps to evaluate the traversed path much more graphically than the most scrupulous analysis. I would like to use precisely this comparison. Before the victory of the Soviet power, Armenia did not have a single scientific institution or higher educational institution. Today within the walls of the republic Academy of Sciences alone extensive research is being done on all the most important trends of knowledge, in the fields of mathematics, physics, chemistry, astrophysics, biology and geology.

But this does not mean that we are striving to be a smaller copy of a "large" academy. The fraternal union of republics in our country, built on close interaction, permitted the Armenian science to have its own face, to develop the research where we could achieve perceptible results and make our own contribution.

This principle has completely justified itself in practice: all of our more or less significant advances have been made precisely where they have been successively implemented. Thus, for example, the entire world has recognized the work of our mathematicians in the field of the theory of functions and integrated geometry. At the same time, in addition to theoretical results, the republic scientists have achieved great success in creating new types of mathematical machines.

Our physicists have also obtained important results. For example, they have experimentally found transitional radiation, made extensive work on the theory of radiation transfer, and have made great advances in the area of creating crystals which have been widely used in optical devices. Theoretical studies on radio physics have revealed new highly sensitive receivers and apparatus which will be employed in industry, medicine, and outer space research. The authors of the works, colleagues of the Institute of Radio Physics and Electronics of the Armenian Academy of Sciences have not only created devices and set up their manufacture in small series, but even now are actively participating in organizing their industrial production.

This example graphically confirms an old rule: only he who is firmly standing on his own feet can offer help. In other words, where there is a high level of basic research, the help to practice is more perceptible. Say that the theoretical studies of our chemists in the area of oligomers made it possible to synthesize substances which are very important for the development of the cable industry. Based on original methods of fine organic synthesis, the republic scientists have created and introduced into production a whole series of highly effective drugs. The colleagues of the Institute of Chemical Physics in cooperation with their Moscow colleagues and specialists of the Kirovakan Plant of High-Temperature Heaters have created new technology which significantly simplified the production process, reduced the consumption of scarce molybdenum and the expenditures of electricity, and yielded a saving of hundreds of thousands of rubles. The work of the scientists of the Institute of Microbiology in the area of creating resources for plant protection, fertilizers, feed and food additives promises to have a high practical yield.

Armenia is rich in ore and nonore minerals. The scientists and geologists have done a lot to study and use them.

"Close integration of science and production is an urgent requirement of the modern epoch," stressed Comrade L. I. Brezhnev from the podium of the 26th Party Congress. I had the opportunity to participate in this meeting. The meaning of this integration is not only that science must help production, it is primarily obliged to offer it new paths of development. This can only be done on the basis of basic research. It is precisely this research which has been started in the institutes of the academy that creates the scientific basis for the development in the republic of new and modern sectors of industry, electrical engineering, instrument making, radio engineering, electronics, microbiology , for the organization of production of new synthetic drugs and pure chemicals. It is clear from here that basic science must be developed at leading rates.

At the same time, experience of the past years has shown that in the matter of using scientific achievements, the special design offices and experimental industries that are set up in the research institutes have a large role. They make it possible to bring the scientific developments to a level which ensures their successful introduction into production and serve as a reliable binding link to practice. We intend to continue the line towards the creation of these subdivisions in the future. We see in them one of the reserves for enhancing the role of science in solving the tasks of the five-year plan, and further strengthening of the might of our multinational country.

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ARMENIAN S&T DEVELOPING MANY SPECIAL PURPOSE AND COMPLEX PROGRAMS

Yerevan KOMMUNIST in Russian 30 Mar 82 p 2

[Article by A. Agababov, chief of the science and technology section of the Armenian SSR Gosplan: "How Potential is Utilized"]

[Text] The 11th Five-Year Plan is a period for the further development of the economy of Soviet Armenia in the areas determined by the decisions of the 26th CPSU Congress and the 27th Armenian Communist Party Congress. The process of rational geographical distribution of production forces is continuing, and the fight for effective utilization of labor resources and for limitation of large-city growth is being strengthened.

The broad program for development of the republic economy is based above all on increasing the effectiveness of civil production, a chief factor in which is broad introduction of scientific and technical achievements into production. During the current five-year period, the acceleration of scientific-technical progress is based on the solution of special-purpose and complex programs and of the most important scientific-technical problems.

Republic scientific institutions will take part in the solution of 9 special-purpose and 24 complex programs approved by the USSR State Committee for Science and Technology, USSR Gosplan, and the USSR Academy of Sciences. They cover a number of research and development projects in the fields of the fuel-energy complex, chemistry, health, computer technology, and so forth.

Also provided for is the conduct of scientific research according to special-purpose and complex scientific-technical programs of republic significance. Among them are problems in the development of energy with consideration for solar and geological potentials, the complex utilization of ores, the complex utilization of local non-ore materials, the development of the salty soils of the Ararat Valley, and so forth.

During the years of the 10th Five-Year Plan, and also in 1981, significant successes were achieved by collectives of the scientific institutions doing research in the physical-mathematical and physical sciences, ehcmical engineering and the microbiological industry, agriculture, and construction. Research was completed on over 400 topics, and over 3000 very important measures for new technology were introduced, with an economic effect of about 250 million rubles.

But along with the successes achieved in the activities of individual scientific institutions, there are serious shortcomings. The situation is evidenced by the fact that not all scientific institutions have reexamined subject plans in the areas related to solving the most important scientific-technical problems. Thus, the ArSSR Academy of Sciences institutes of radiophysics and electronics, physical research, and mechanics, which are well equipped and provided with highly qualified personnel, virtually do not take part in research that is financed from the budget for complex programs approved by the USSR State Committee for Science and Technology, USSR Gosplan, and the USSR Academy of Sciences.

Only about 10 percent of the topics in all-union special-purpose programs are worked on by scientific institutions of the Department of Chemical Sciences of our academy. Here, the participation of scientific workers in the solution of environmental problems is extremely insufficient. There is an analogous situation in units of the Department of Biological Sciences of the academy.

In all, about half of the scientific institutions subordinate to the ministries of health and agriculture are participating in the solution of special-purpose and complex programs.

The absence of a purposeful subject plan in individual scientific institutions facilitates the predominance of petty topics and leads to the dissipation of resources of personnel, supplies, equipment, and finances. A direct consequence of such factors is the lowering of the work effectiveness of the institution as a whole.

In recent years, in republic scientific institutions, there has been the practice, not at all justified, of creating small organizational units, new branches and sections, design-technological bureaus, and computer centers. In our view, there is no justification for the organization in Yerevan of the section of the Institute of Construction Economics of USSR Gosstroy. Research in this field could be accomplished in the Scientific-Research Institute of Economics and Planning of ArSSR Gosplan. Such examples, unfortunately, are not unique.

In the system of the republic Academy of Sciences, ten design-technological bureaus and a special experimental design technological institute in Leninakan have been organized. Their creation has undoubtedly accelerated the introduction of development results into production. However, not all of them are equipped properly. As a result of this, a majority of them have b ecome units with little capability.

To strengthen the supply and equipment base of the special design bureau and design bureaus, it would be advisable to enlarge them and subordinate them to Departments of the Academy of Sciences, that is, to organize capable, interinstitute, specialized design bureaus or design-technological institutes with experimental shops able to develop technical-planning documentation and to assimilate experimental-industrial production, and manufacture of new types of manufactured items, materials, instruments, and apparatuses.

About 20 computer centers, subordinate to various ministries, agencies, and associations, have been organized in the republic. But there is not one computer center for collective use. This is a serious shortcoming in the utilization of expensive computer technology that lowers its effectiveness and fosters the dissipation of

efforts by leading specialists in this field. The decisions on creating computer centers for collective use are not being carried out.

Much greater attention is deserved by the positive experience of the scientific council of the ArSSR Ministry of Agriculture, which annually examines and coordinates the subject plans of agricultural institutions in applied science field, independent of their agency subordination.

The increase in effectiveness of scientific institutions' work is a task of first-degree importance. Guided by this requirement, it is necessary again to examine subject plans, subordinating them in maximum degree to the solution of special-purpose and complex programs and to close down and break off research on subjects that contain no innovations and that have no economic meaning. This is the need of the day. There should be an increased role for scientific councils of scientific institutions and for coordination councils and departments of the ArSSR Academy of Sciences.

Along with these measures and in correspondence with them, there must be changes in the structure of institutions so as to repudiate the organization of small, insufficiently equipped units that are not able to carry out work on urgent problems in short periods.

Among the chief problems remain those that relate to the introduction of completed scientific developments into the economy. Unfortunately, in our republic, there are cases where introduction is delayed. In the report by the first secretary of the Armenian Communist Party Central Committee, Comrade K. S. Demirchyan, at the November plenum of the Central Committee, serious criticism was directed at the ArSSR Ministry of the Construction Materials Industry, which, for over 20 years, has not been able to complete work in introducing into industrial production the technology for producing crystal from local raw materials, particularly "canasite."

According to a proposal by ArSSR Gosplan back in 1977, a decree was adopted on the organization of production and the wide application of chlorella in livestock breeding. In solving the problem, provision was made for participation by the Institute of Hydroponics and Agrochemical Problems of the Academy of Sciences, the Institute of Livestock Breeding and Veterinary Medicing of the Ministry of Agriculture, a number of livestock-breeding complexes, and so forth. During the last few years, an experimental facility of the Yegvard Livestock Breeding Complex has been built and has begun to function, and a facility has been built at the Echminadzin scientific-production base of the Institute of Agrochemical Problems and Hydroponics. However, the measures taken have not brought about wide introduction and application of chlorella in livestock breeding. There is a similar situation with respect to growing grafts for vinyards by the hydroponic method.

Developments by the Institute of General and Inorganic Chemistry in purifying sewage at the Yerevan Silk Combine are being introduced too slowly. Such examples are far from unique.

Speaking at the November plenum of the CPSU Central Committee, L. I. Brezhnev said: "The State Committee for Science and Technology, the Academy of Sciences, ministries, and agencies must fulfill more energetically the decisions of the 26th CPSU Congress on the effective utilization of scientific-technical potential and must accelerate the introduction of new technology."

The instructions of Comrade Brezhnev fully pertain to the ministries, agencies, and Academy of Sciences of the republic, which are called upon to accomplish serious tasks in accelerating scientific-technical progress and for increasing effectiveness of the work of scientific institutions.

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ANNUAL MEETING OF BELORUSSIAN ACADEMY OF SCIENCES

Minsk SOVETSKAYA BELORUSSIYA in Russian 16 Mar 82 p 3

[Article: "Creating the Force of Science: Session of the Annual General Meeting of the Belorussian SSR Academy of Sciences"]

[Text] The blossoming of Soviet science, its rapidly growing creative potential have become one of the clear indications of the triumph of the vital source of the plans for Communist construction developed by the party. For it is precisely science which has been converted into a powerful production force which was the focus of especial attention in the decisions of the 26th CPSU Congress which aimed the scientists to more active participation in realizing the most important problems of long-term progress of the Soviet society, and transferring the economy to the path of intensive development.

How these important tasks were fulfilled in the first year of the five-year plan was the object of a demanding fundamental discussion at the session of the annual general meeting of the BSSR Academy of Sciences.

The starting year for scientific subdivisions of the BSSR Academy of Sciences was successful, President of the BSSR Academy of Sciences, Hero of Socialist Labor, Academician of the USSR Academy of Sciences N. A. Borisevich noted in his opening speech. The achievements of scientists in the area of basic research, further expansion in the range of scientific search, strengthening bonds between science and production, and accelerated introduction into the national economy of the results of scientific development were significant. Colleagues of the academy published 315 books and brochures, and about 5,000 scientific articles. A total of 327 developments were introduced into the national economy with economic effect of R 168 million. A total of 907 certificates of authorship were obtained for inventions, 202 diplomas and 78 medals of different exhibitions.

Scientific collectives of the BSSR Academy of Sciences also achieved high results in the socialist competition. Thus, the Institute of Heat-and Mass-Exchange of the BSSR Academy of Sciences imeni A. V. Lykov for successful solution to the most important scientific and technical problems was awarded the challenge Red Banner of the CPSU Central Committee, USSR Council of Ministers, AUCCTU and Komsomol Central Committee. The Institute of Solid State Physics and semiconductors of BSSR Academy of Sciences was awarded the challenge Red Banner

of the Belorussian Communist Party Central Committee, BSSR Council of Ministers, Belorussian trade union and Belorussian Komsomol Central Committee for achievements in developing and introducing into production scientific innovations of high economic effectiveness.

In the year when the country is preparing to mark the remarkable 60th anniversary for formation of the USSR, deep sources of our success are especially perceptible. This is the indestructible friendship of the Soviet peoples, fraternal mutual help of the union republics which makes it possible to unite efforts for the most rapid resolution of urgent economic and social problems.

In the 10th Five-Year Plan the BSSR Academy of Sciences mainly switched to the program-target method of planning and coordinating scientific research in the area of natural and social sciences, chief scientific secretary of the Presidium of the BSSR Academy of Sciences, Academician of the BSSR Academy of Sciences L. I. Kiselevskiy stated in his report regarding scientific and scientific-organizational activity of the BSSR Academy of Sciences in 1981. In the accountability year, the institutes of the academy participated in developing 30 union scientific-technical programs, as well as 32 republic . This organization of basic research fostered the concentration of main forces and resources on the most urgent trends in science, improvement in comprehensiveness and the level of coordination of research, expanded participation of the VUZ's, sector scientific research institutes and enterprises of the republic in implementing the most important national economic tasks.

The scientists of the academy, for example, headed the development of the republic comprehensive program for scientific and technical progress and its social-economic consequences up to the year 2005, scientific-technical programs to create and organize the manufacture of experimental samples of high precision instruments, development and introduction of enterprises of laser instruments and technolgies, process of microbiological synthesis of feed protein substances, processes and materials for corrosion protection of machines and equipment, production of new materials and designs based on polymers, and environmental protection.

Cooperation with the academies of sciences of the union republics was expanded and deepened.

In the Third Five-Year Plan, fruitful cooperation and socialist competition is continuing among the scientists of Belorussia and Lithuania. The work plan for 1981-1985 stipulates joint research on 40 topics. It also includes questions of training skilled cadres, joint use of an experimental base, conducting of expeditions, publishing of monographs and thematic collections, and expanding the circle of scientific and cultural-mass measures. Not only the institutions of both academies will participate in its fulfillment, but also certain VUZ's, as well as sector scientific research institutes.

The academies of sciences of the Ukraine, Belorussia and Moldavia successfully cooperated. In 1981, they began to realize seven regional problems. The BSSR Academy of Sciences headed programs to develop scientific-technical fundamentals for creating fast-neutron reactors with dissociating heat carrier and to investigate the geological structure of the territory of the Ukraine, Belorussia and

Moldavia in relation to the tasks of developing the mineral-raw material base for the national economy and efficient use of natural resources. Cooperation is also fruitfully developing among the scientists of our republic and Tajikistan.

Joint searches with the scientists of the Latvian SSR in the area of automating scientific research are continuing. Development of a new program of basic and applied research on this problem for 1981-1985 has been completed.

The report of the chief scientific secretary focused a lot of attention on other problems of coordinating scientific searches, in particular, expanding and strengthening creative ties between the institutes of the BSSR Academy of Sciences and higher educational institutions. Basic research for medicine must be more intensively developed.

Speaking about the definitive importance of long-term basic research which is successfully underway in all scientific subdivisions of the academy, the participants of the meeting noted that in the last year the practical significance of the results of scientific searches was perceptibly improved, and introduction into production of completed developments was accelerated.

The Institute of Electronics of the BSSR Academy of Sciences, for example, has investigated the effect of electromagnetic and laser radiation and acoustic fluctuations on physical phenomena occurring on the surface, interphase boundaries and in multilayer metal, dielectric and semiconductor film structures.

On this basis, new materials, instruments and technological processes have been developed. As a result, dozens of units of technological and measurement equipment have been created jointly with the production engineers. The institute has obtained about R 19 million of economic effect from introducing power semiconductor devices in machine construction, automobile and tractor construction alone.

The Physical-Technical Institute of the BSSR Academy of Sciences has created theoretical and technological foundations for high-speed thermal treatment of multiple-component titanium alloys, spring materials, automobile sheet steel and stainless steel. The research results were used by the Novolipetsk metallurgical kombinat and other enterprises of the country.

The scientific fundamentals for synthesis and technology of production of mechanically strong high-temperature porous material designed for production of liquid fuels made of carbon dioxide and hydrogen have been developed in the Institute of General and Inorganic Chemistry. The practical use of the findings will be very important because of the shortage of liquid fuel.

The collective of the Institute of Technical Cybernetics of the BSSR Academy of Sciences has developed and introduced at the enterprises of Leningrad and Tula an experimental complex of technological and programmed devices for automated solution of design and technological tasks in machine construction. The economic effect from its introduction was about a million rubles.

The information-search system set up in the Institute of Mathematics of the BSSR Academy of Sciences has been recommended to many ministries and departments in the country. Its use resulted in an economic effect of almost R 1.5 million in 177 organizations.

The Institute of Physics of the BSSR Academy of Sciences has developed and introduced into practice of scientific research and production new physical instruments and units. Industrial manufacture of some of them has been set up. For example, the introduction of methods and apparatus for studying the parameters of the atmosphere and near-surface layer of the ocean yielded an economic effect exceeding R 800,000.

The scientists of the Institute of Problems of Reliability and Durability of Machines of the BSSR Academy of Sciences have issued recommendations to reduce the dynamic load and vibration activity of tractor gear box drives of the Chelyabinsk tractor plant.

Introduction of technological processes for radiation treatment of semiconductor instruments and tools equipped with polycrystals of superhard material "El'bora-RM," developed in the Institute of Solid State Physics and Semiconductors is successfully continuing.

Technological processes and equipment, as well as new metal-polymer materials and designs made of them created in the Institute of Mechanics of Metal-Polymer Systems of the BSSR Academy of Sciences have been introduced at 38 enterprises of different sectors of the national economy with economic effect of over R 5 million.

Practical use in agriculture of the methods for controlling weeds in lupine crops, as well as potato diseases suggested by the Institute of Experimental Botanics imeni V. F. Kuprevich has expanded. The Institute of Genetics and Cytology, Central Botanical Garden and other scientific subdivisions of the BSSR Academy of Sciences have also given their developments to agriculture. The recommendations of the Institute of Zoology of the BSSR Academy of Sciences are widely used in the area of protecting and efficient use of the Belorussian fauna.

A lot of research in the field of social scientists has been completed with weighty results. Thus, linguists have prepared eight issues of the "Historical Dictionary of the Belorussian Language." The dictionary contains a glossary of Belorussian written language of the 16th-18th centuries. It is based on manuscript and sources published before the 18th century, many of which have been used for this research for the first time. The lexical richness which it contains characterizes the level of development of spiritual and material culture of the Belorussian people in the past. The dictionary has great scientific and cultural importance.

The social scientists have dedicated a number of works to the imminent 60th anniversary of the formation of the USSR.

In speaking of the advances made in introducing completed scientific developments into practice, the speakers noted that far from all the reserves are being used

here. The contribution of the scientific subdivisions of the BSSR Academy of Sciences to the general money box of the economy is not the same. The facilities of the experimental base of the BSSR Academy of Sciences are not being sufficiently completely utilized. The periods for development and manufacture of new equipment are often prolonged.

A definite system of interaction between academic science and production has formed in the republic. Many institutes efficiently utilize the base of the enterprises to verify the results of research to organize output of new products. However, the system of interaction between scientists and production engineers requires further improvement and comprehensive expansion.

Science, like the national economy as a whole, is switching to an intensive path of development where new major tasks will be solved without increasing the number of people involved in the sphere of scientific search. This is why questions of automating research based on the extensive use of computers and mathematical methods, problems of efficient use of complicated equipment with the help of time-sharing centers occupy an important place in the activity of the BSSR Academy of Sciences. Participants in the annual meeting analyzed in detail the work done here, and stressed that its volumes must significantly rise in the near future.

The report and speeches of the scientists discussed the results of inventor and patent-license activity, the tasks associated with more intensive training of scientific cadres, and revealed the reserves for improving scientific-organizational work.

The participants in the meeting noted with satisfaction that in 1981 international cooperation of the BSSR Academy of Sciences fruitfully developed. Academic institutes maintained creative ties with more than 90 foreign scientific research centers on 67 scientific-technical problems. As a result, a number of important theoretical and practical results were obtained.

Academicians of the BSSR Academy of Sciences L. M. Sushchenya, V. P. Platonov, corresponding members of the BSRR Academy of Sciences V. A. Labunov, N. I. Arinchin, V. B. Nesterenko, V. S. Soldatov and P. A. Apanasevich participated in discussing the report regarding the activity of the BSSR Academy of Sciences. Scientific reports were given by Academician of the BSSR Academy of Sciences A. G. Shashkov and corresponding member of the BSSR Academy of Sciences S. V. Martselev.

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SCIENCE AND TECHNOLOGY IN BELORUSSIA

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 27 Mar 82 p 4

[Abridged articles by N. Ilinskaya: "Science and Technology in Belorussia"]

[Summary] In the united family of fraternal Soviet republics Belorussia is known as a supplier of such products as powerful Belaz and Maz lorries, Belarus tractors, radio and TV sets of the Minsk Radio Factory, computers and refrigerators of the Minsk model and modern Elektronika watches. Belorussian scientists have made their contribution to the design and manufacture of each of these top-quality products. Belorussia has about 200 research institutes and higher schools. Their staff includes 38,600 research associates, including 810 Doctors of Science and over 11,000 Candidates of Science. Scientists have many inventions to their credit. In 1981 alone 900 authors' certificates were granted to scientists of the Belorussian Academy of Sciences and if one takes into account the 10th five-year plan period, over 5,000 such certificates. Research and development work in the last six years helped save more than 500 million roubles. Some of the achievements of Belorussian scientists are described below.

MATURE SCIENCE

Academician N. Borisevich, President, Belorussian Academy of Sciences, Hero of Socialist Labour

Belorussian science owes its birth and successful development to the October revolution. It is symbolic that the first research institution in the republic--the Institute of Belorussian Culture--was set up in 1922, the year of the formation of the USSR. Seven years later it was transformed into the Belorussian Academy of Sciences. Today its five departments unite 32 institutions working along the major lines of research.

The main objective of the Belorussian Academy of Sciences is to develop fundamental studies. The Academy's research institutes should advance fundamentally new ideas and profoundly develop them. But laying a scientific groundwork we should think of the edifice which will be built on it. That is why our institutes are vigorous initiators of the introduction of the results of their research into practice.

For instance, on the basis of fundamental studies the Institute of Mathematics has created the hardware for the Unified Computer System. This hardware is used in almost 2,000 organizations in the USSR. The Institute of Engineering Cybernetics is the USSR's leading research centre specializing in the use of mathematical methods and computers for automating the design and the technological preparation of production in the machine-building industry.

In recent years much has been done for accelerating the introduction of the results of research into practice. In the past five-year period alone the economic effect of introducing the results of research into production has tripled and reached 345 million roubles. This has been achieved through solving major problems and through introducing new forms of linking research and practice. The Academy has begun to switch over on a broader scale from contacts with individual enterprises to direct ties with ministries, departments and large associations and to work with them under joint plans.

Our broad creative links with scientists of other republics are an example of internationalist cooperation between the fraternal Soviet republics. For instance, for almost a decade the Academies of the Ukraine, Belorussia and Moldavia have been conducting joint research into the problems of the rational use and protection of the waters in the basins of the Dnieper, Pripyat and Dniester Rivers.

For more than ten years our Academy has been fruitfully cooperating with the Lithuanian Academy of Sciences. Under the new contract with the Academy of Sciences of Tadzhikistan we are to carry out scientific investigations into 14 problems and to mutually introduce the results of research into seven topics. We have concluded a contract on creative cooperation with the Latvian Academy of Sciences aimed at raising the level of the automation of research.

This list does not include all our contacts: the institutions of the Belorussian Academy of Sciences perform scientific investigations into individual problems jointly with the institutions of the Uzbek, Kazakh, Georgian, Azerbaijan, Kirghiz, Armenian and Estonian Academies of Sciences. This experience of many years has vividly shown that the joint efforts of scientists of the constituent Soviet republics ensure a rise in the scientific and technological progress and strengthen friendship between Soviet nations.

PHOTONS VIE WITH ELECTRONS

V. Pilipovich, Academician of the Belorussian Academy of Sciences,
Director, Institute of Electronics

It seems that weather forecasting concerns primarily weathermen. But last year the five-year International Programme of atmospheric Processes was launched. Its implementation called for a lot of precise instruments. Our institute was to design some of them. In particular, we were to develop the optical methods and instruments for recording the ozone content in the atmosphere.

The task was not easy at all. The size and weight of the instruments had to be minimal; they were designed for flying laboratories and meteorological rockets. At the same time it was necessary to achieve the high accuracy and reliability of the instruments' operation and high speed in processing and transmitting information. Within a short time the institute could cope with this difficult assignment only because previously we had made appropriate theoretical studies.

The original method of ultrasonic microwelding for integrated circuits was conceived. The gist of the method is that acoustic vibrations of a broad spectrum of frequencies ranging from infrasonic to hypersonic ones are supplied to elements which are to be connected. Sometimes these elements are invisible to the naked eye. This method can be used in assembly of radio equipment, vacuum electronic, optoelectronic and acoustic devices.

Creating the scientific foundations of electronics and various devices we often discover the most unexpected fields of applying the results of our research. For instance, a measuring complex has become a reliable means for controlling the breakage of fibre in weaving. The studies of the effect of laser emission and acoustic vibrations on multilayer pellicular structures have led to the creation of new materials with prescribed properties. The use of new materials enabled the institute together with production workers to design small power semiconductor devices whose faultless operation in the systems of the electric drive of machine-tools, in automobile construction and tractor engineering yielded the economic effect running into 19 million roubles for our institute.

Optoelectronics is another young line of research conducted at the institute. It promises a lot of interesting practical applications. Particles of light--photons--are information carriers here. They are neutral electrically, do not interact with each other in the communication channel and are insensitive to the effect of electromagnetic fields. That is why optical communication is practically devoid of interference.

In the not too distant future optical systems will penetrate not only communication technology. Smooth automatic control is possible only on the basis of light guides. Optoelectronics will raise household equipment to a new level. Without leaving a flat one will be able to read on the screen rare books form the stocks of the Lenin Library, to examine museum exhibits and to speak over the telephone seeing the interlocutor. Fundamental research is aimed at bringing this future closer.

THE SPRINGS OF VITAL FORCE

I. Lishtvan, Academician of the Belorussian Academy of Sciences, Director, Institute of Peat

Most people regard peat as ordinary fuel. However, this product of the partial decay of marsh plants can retain and accumulate biologically active substances contained in them. Moreover, as our studies have shown, in the

course of the formation of peat new valuable chemical substances are synthesized.

For instance, a growth stimulant of farm crops has been obtained at our institute on the basis of peat. It is applied in the soil together with water--six to eight kilograms of the growth stimulant per hectare. As a result, the green mass of maize increases by 40 to 60 per cent, and the content of the valuable protein in green mass rises by about 40 per cent.

New types of complex organo-mineral fertilizers have been created on the basis of peat. In such fertilizers peat is used in combination with the dry remnant of industrial sewage and the waste of superphosphate and potassium production. At present in the Belaruskaly (Belorussian Potassium) Assoication alone annually up to 1.5 million tons of salt slime turn into waste in terms of dry substance. In other words, more than 200,000 tons of potassium--an important ingredient of plants' feeding--are wasted. New fertilizers, as the experience of many Belorussian farms has shown. ensure a sizable increment of the harvest: up to 3-3.5 centners of cereals, 20 centners of potatoes and 40 centners of sugar-beet per hectare.

We have concluded from our investigations of the chemical composition of peat that some of its constituents possess very valuable remedial properties. Our institute has developed the methods of cleaning and concentrating these substances in close cooperation with medical institutions. One of the results of our joint work is Torfenal medicinal creme which possesses a diversified therapeutic effect during the treatment of skin diseases.

At the same time the concentrates of physiologically active substances from the resinous part of peat wax have proved to be excellent ingredients for obtaining cosmetics and perfumery. For instance, various medicinal shampoos and special liquid detergents for children are being tested. They do not irritate the skin, do not injure the mucous membrane of eyes and have the anti-inflammatory effect. The top-quality Pushinka mascara in which wax compounds of peat are the main ingredient does not cause allergy. The Bytkhim factory in Brest has started to produce a hand cleaning agent. It consists of biologically active and nutrient substances--products of the resin of peat wax. They not only efficiently remove paint, soot, resins, lubricants and household pollutions from the skin, but also soften it, contribute to the healing of scratches and grazes and prevent skin diseases.

The merits of peat are innumerable. The technology of the comprehensive chemical processing evolved by the institute has been protected by 20 authors' certificates.

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BELORUSSIAN EXPERIMENT WITH ACADEMIC-DESIGN-PRODUCTION COMPLEXES

Minsk KOMMUNIST BELORUSII in Russian No 2, Feb 82 pp 77-82

[Article by I. Serzhinskiy, head of the sector for the economics of scientific research of the Institute of Economics of the BSSR Academy of Sciences and a candidate of economic sciences, and V. Tsygankov, junior scientific associate: "In search of Organizational and Economic Solutions: The Integration of Science and Production"]

[Text] In the republic Academy of Sciences, a system has evolved for active contacts by academy institutes with scientific research institutes, VUZ's, ministries, and industrial enterprises of economic sectors. Economic agreements represent the basic, well-proven form of this relationship. During the years of the 10th Five-Year Plan, their volume grew by a factor of 2.2 and, in 1980, reached 35 million rubles, which makes up 53.7 percent of the total volume of financing for scientific research work.

Of course, however, the matter is not just one of numbers. Although, if you look at them dynamically and compare the indicators during the last five years, the growth, which is significant, will be obvious. The party has placed a clear and specific task before scientists: knowledge must be materialized in production. This brings about the necessity for an active search for new organizational forms that provide for the integration of scientific and production activity and the acceleration of the process of introducing the results of scientific-technical achievements into the economy.

Much in this area also is being done in our Academy of Sciences. Thus, one of the qualitatively new forms has been the uniting of fundamental research with design work and experimental production within the framework of academy scientific-technical complexes (ASTC's). An ASTC consists of an academy institute, a design bureau, and an experimental shop.

The basic task of these complexes is the rapid and qualitative creation, based on scientific research, of design or technological developments and the fabrication of experimental models and the transfer of these models or developed and tested technology to industrial enterprises. There are already eight such complexes in the BSSR Academy of Sciences system. Their appearance has been made possible largely by the creation of our Central Design Bureau with an experimental shop, the task of which includes the conduct of experimental-design work on the results produced by

the process of fulfilling scientific research projects. Later, it was divided into special design-technological bureaus with experimental shops directly at academy institutes. Thus were formed scientific-technical complexes.

It should be noted that ASTC's have a number of characteristics in common with scientific-production associations, which have become the most widespread organizational form for relations between science and production operating in sectors of the economy. Here, as in scientific-production associations, the head organization is a scientific-research institute. In accordance with its plans, the Special Design-Technological Bureau with an experimental shop directs its activities. This unit develops and introduces design and technological solutions based on the use of scientific ideas that were produced in the course of fundamental and applied research by scientists. Together with the institute, the Special Design-Technological Bureau bears responsibility for the timeliness and quality of design-technological developments, their scientific-technical level, and effectiveness of utilization in the economy.

The organizational structure of the ASTC's, on the one hand, permits -- and this is very important -- the simplification of decisions on the development of technical documentation and the fabrication of experimental models and reduces the gap between completed scientific research and its experimental testing. On the other hand, the strengthening of the design and experimental bases permits academy institutions to solve fundamental problems more effectively and to expand significantly the scale of utilization of their scientific developments and, most important, to accelerate carrying forward fundamental research results to realization in production. It is sufficient to say that the ASTC at the present time accounts for about 60 percent of the work introduced into the economy by the BSSR Academy of Sciences and over half of the economic effect. During the last 10 years, the volume of products manufactured by the complexes grew by a factor of almost 4 and, at the same time, the number of people working in these organizations increased by a factor of about 2.

Speaking at the November (1981) plenum of the CPSU Central Committee, General Secretary of the CPSU Central Committee, Comrade L. I. Brezhnev, justifiably noted that far from all design and scientific-research institutes "are operating as required by the present stage of scientific-technical progress." Actually, it was possible, undoubtedly, to achieve more. As practice shows, there is not full utilization of the broad opportunities to increase the effectiveness of scientific research and to accelerate scientific-technical progress that are being opened up by giving design-technological services and experimental shops to academy institutes. The basic reasons for this situation are as follows: a number of economic problems in creating the complexes and making them function has still not been solved, and full organizational and economic unity has not been achieved between scientific-research and experimental-design units. Each of them lives apart, and administrative activities are conducted separately. In all eight complexes, their organizational elements are independent entities. Such scattering, which is characteristic not only of our republic, interferes with successful work.

The absence of a system for comprehensive planning, the unsatisfactory level of centralization of the most important functions for managing scientific-research and experimental-design work, and insufficiencies in supplies and equipment also have

a negative effect on reducing the time required to create new technology models. All of this hampers the utilization of progressive forms of work organization as special-purpose orientation toward development and research, incentives for final results in the activity, and overlapping in time of different stages of the "research-production" cycle. There is a failure to introduce so-called dynamic organizations -- task-oriented units that change composition in the process of fulfilling specific tasks.

Thus, the creation of ASTC's, to a significant degree, has helped to accelerate scientific-technical progress but, at the same time, they are not taking advantage of a number of opportunities; this restrains the achievement of the maximum effectiveness of this form of relations between science and production. There is one conclusion: there must be improvement in the organization and management of the process for creating and introducing new technology, responding to objective trends in the development of science at the present stage. Practice convinces us that there are many possibilities for this.

At the 19th plenum of the Belorussian Communist Party Central Committee, it was noted: "In scientific areas of a multi-sector character, academy scientific-technical associations could be organized according to the experience of the UkSSR Academy of Sciences." For the complex institutes presently existing in the republic Academy of Sciences this means adding another organizational element -- an experimental plant. And, although such plants still do not exist, the trend toward creating them has gained a rather strong foothold. Thus, a plant is being constructed in Gomel' at the Institute of the Mechanics of Metal-Polymer Systems. The experimental plant of the institute yearly delivers to the country's enterprises and organizations up to 39 units of various equipment and, in some instances, adjusts them and puts them in operation. Analogous plants are now required at a number of other institutes -- Physical-Technical, Problems of Machine Reliability and Durability, and Heat and Mass Exchange.

How can this problem be solved? At the 19th plenum of the Belorussian Communist Party Central Committee it was said that a substantial role here should be played by the largest Belorussian enterprises, which could share in the construction of plants, the products of which they themselves needed.

The creation of academy scientific-technical associations under the BSSR Academy of Sciences will also allow fuller solution of a number of organizational-economic problems that were discussed above. First of all, there will be a possibility to eliminate economic and legal independence of organizational units that enter into associations. What will this achieve? First, it is possible to prepare before hand all material, financial, and labor resources necessary to fulfill the whole complex of work in creating and assimilating new technology. Secondly, continuity is provided for the "research-production" cycle. Thirdly, there is real concentration of effort on the fulfillment of the most important economic tasks.

An important feature of academy scientific-technical associations is the high level of centralization in the management functions of scientific-production activity. The experience of the Kiev Institute of Electric Welding imeni Ye. O. Paton shows that, in creating associations, there appear economic conditions that provide for the introduction of matrix management structure as the most advisable for complex organization. In this connection, scientific-technical management of a created

program, the mutual relationships of individual units, and the coordination and control of fulfillment of work within a prescribed period are accomplished by the director of a complex task. He, together with those responsible for implementing individual stages, develops a unified complex plan, provides for sequential or parallel conduct of individual projects, and determines responsible performers and coperformers. The time periods for conducting research are determined simultaneously with the technological sequence.

Of course, no experience, even the very best, simply can be transplanted to different "soil." Unavoidable, it will be transformed with respect to local conditions. It will undoubtedly be this way with the creation of academy scientific-technical associations in Belorussia.

At the same time, it is clear that associations are by no means the only form for integrating science and production. This is especially true if we speak of cooperation among agencies and among economic sectors -- this is a sphere that has large hidden reserves. At the same time, excluding state programs, it has been based up to now largely on short-term economic agreements and on agreements for socialist cooperation and for transfer of scientific-technical achievements.

During the years of the 10th Five-Year Plan, still another organizational form for relations between science and production has appeared. Mainly, this is a unit (laboratory) with dual subordination, the basic aim of which is to accelerate the introduction, at interested enterprises, of the results of the scientific research of academy institutes. Experience in the functioning of units with dual subordination was approved at the 29th Belorussian Communist Party Congress as a promising form for the integration of science and production.

The problem is that fundamental research at academy scientific-research institutes, as a rule, does not provide finished design or technological solutions. It permits, in the best case, the establishment of possibilities in principle for the implementation of an idea. It has happened and still often happens that, despite the innovations and good prospects for scientific developments, industrial enterprises accept them unwillingly because of absent or incomplete design-technological preparations.

One way to solve this problem is to create units with dual subordination. Let us say frankly that this is not our discovery: such units were first created 15 years ago under the Siberian Department of the USSR Academy of Sciences. They represented a scientific-technical system of economic-sector scientific-research institutes, design bureaus, and experimental plants, the scientific direction of which was entrusted to the Department of the USSR Academy of Sciences, while the administrative functions and financing remained in the respective ministries. Thus, the scientific-research institutes and design bureaus have dual subordination. Prospective developments of academy institutes are transferred to scientific-research institutes and design bureaus, often together with qualified personnel. This permits starting technological and design work at the earliest stage and cutting in half the time necessary for introducing scientific-research results into production.

Definite positive experience in organizing units with dual subordination, though not on this scale, also has been accumulated in our republic. Thus, such laboratories have been created at the Institute of Problems of Machine Reliability and

Durability, together with the Minsk Machine-Tool Building Association imeni Oktyabr'skaya Revolyutsiya and the Minsk Motor Plant. One of them is engaged in a search for optimum solutions in increasing reliability of prospective elemtnts of machine-tool design with numerical program control; the second is the development of methods for increasing the power of tractor engines. Both cases employ the results not only of fundamental and applied developments by the institute, but also the design-experimental work of production people.

General management of the laboratories is accomplished on an equal footing by the institute and the respective enterprise and by a scientific council of the institute and the technical council of the enterprise. And the achieved results are first introduced at the plant which finances the laboratory.

There are many fine points in the activities of the laboratories and, to define their basic features, the BSSR Academy of Sciences has created a typical charter for units with dual subordination, which have already shown their usefulness, although there are also still some unsolved problems relating particularly to the development of methods for determining the effectiveness of these units, to the social and everyday support of the laboratories, to the definition of their legal status, and so forth.

But this form of science-production integration also does not exhaust all the many possible organizational solutions. Thus, technical progress of present-day machine building requires still wider application of materials and machine components with hardened working surface. Scientific research in this field is being done by scientists in a number of academy and applied institutes and VUZ's and by specialists at large enterprises. However, hardening technology work, until recently, has not been coordinated and enterprises have not been designated for the experimental-industrial testing of new processes and technological equipment.

The organizational solution of the problem was as follows: the presidium of the BSSR Academy of Sciences created, on a nongovernmental basis, the Republic Scientific-Technical Center for Hardening Technology. It encompasses a number of academy and economic-sector institutes, and also academy associations, created on nongovernmental bases, with BelavtoMAZ, the Minsk Tractor Plant, and enterprises in Gomel'. This has opened up possibilities for the planning and coordination of research, experimental-production testing, and broad introduction of its results.

Thus, in the BSSR Academy of Sciences system, one can note a number of important organizational measures directed toward increasing the effectiveness of the integration processes taking place between science and production. But this problem also has a second, no less important aspect -- the investigation of the active economic mechanism that would permit, as required by decisions of the 26th CPSU Congress, organic union of the achievements of scientific-technical progress with the advantages of socialism.

Analysis shows that a large majority of scientific research done on the basis of economic agreements takes place in the BSSR Academy of Sciences at physics-mathematics and physics-engineering types of institutes. They also provide the basic mass of economic effect produced by implementing developments in production. Measures have now been undertaken so that institutes of the departments of chemical

and geological, biological, and social sciences expand the amount of work done on the basis of economic agreements. But for this problem to be solved more rationally, it seems advisable to restructure the system of material incentives for the development and introduction of innovations created in accord with the subject matter of economic agreements.

Up to now, material incentive funds at academy-type scientific institutions have been formed within the limits of 6 to 8 percent of the yearly wage fund from economic agreements; part of this sum has been transferred to the centralized award fund of the BSSR Academy of Sciences, and the remainder has been distributed by the management of scientific institutions in the course of the year. One of the most important criteria in determining the amount of reward for innovation developers is the conditional annual economic effect. At the same time, one would think that, with the aim of introducing active cost accounting, increasing mutual responsibility on both sides, and providing control over the use of financial resources for the subject matter of economic agreements, funds for material stimulation of interest and material incentives for project performers should be closely related to the economic effect really achieved in the economy.

Effectiveness in introducing the results of the research of republic scientific institutions also can be increased under the conditions of improvement in the quality of technical-economic substantiation of planned research and the preparation of scientific-technical programs. Often, as technical-economic substantiation, information is introduced just on the anticipated economic effect, and the data that characterize the technical-economic advantage of the innovation (degree of technology, productivity, durability, capital content, material content, labor content, etc.) are neglected, although these are the indicators that provide an adequate representation of the object and its advantages in comparison with known analogous domestic and foreign practice.

Questions on improving methodology for calculating economic effectiveness from introding finished scientific-research work arises more sharply in the evaluation of the activities of chemical and biological scientific institutions. Here, it is necessary also to take into consideration the social effect and the ecological consequences of the practical utilization of the results of scientific research and the introduction of developments by a given institute.

Institutions of the Department of Social Sciences are in a special position. The results of scientific research in economics, philosophy, law, history, and so forth, can have social-political, educational-pedagogical, esthetic, and even (chiefly the result of research on improving the organization of material production and labor) technical-economic significance.

To accelerate the process of introducing scientists' achievements into production, there is a call for special-purpose program methods of planning, which are given a great deal of significance in the Academy of Sciences. To a significant degree, owing to these methods, the economic return from science has grown, the scale has broadened, and the lengths of time needed to introduce the results of finished scientific research have been shortened.

Further improvement in the organization and economic measures for managing the process of integrating science and production will permit taking new steps to accelerate scientific-technical progress in the economy and making a heavy contribution to the fulfillment of the decisions of the 26th CPSU Congress.

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ESTONIAN ACADEMY OF SCIENCES HOLDS ANNUAL CONFERENCE

Tallinn SOVETSKAYA ESTONIYA in Russian 24 Mar 82 p 3

[Report by the Estonian Telegraph Agency: "Science for the Five-Year Plan -- From the Annual Meeting of the ESSR Academy of Sciences"]

[Text] On 23 March, the 36th annual meeting of the Estonian SSR Academy of Sciences took place in Tallinn. In a business-like atmosphere, there was discussion of the results of scientific activities by republic scientists and of tasks for increasing their contribution to the accelerated process of the development of Soviet science and, at the same time, the country's economy.

The first year of the 11th Five-Year Plan for the collective of the republic Academy of Sciences, as for the whole Soviet people, said K. Rebane, the president of the ESSR Academy of Sciences and a corresponding member of the USSR Academy of Sciences, in his introductory remarks, has been marked by new achievements in bringing to reality the historic decisions of the 26th CPSU Congress and plenums of the CPSU Central Committee and the instructions contained in the speeches of the General Secretary of the CPSU Central Committee and Chairman of the Presidium of the USSR Supreme Soviet, Comrade L. I. Brezhnev. The plan for scientific-research and experimental work, as well as socialist commitments, have been fulfilled.

The ESSR Academy of Sciences, together with academies of other republics and the USSR Academy of Sciences, during the past year, has taken active part in fulfilling the most important scientific-technical programs in the country. During the present year, these creative relationships and business-like contacts have been strengthened still more and will become more fruitful.

An expanded plan has been worked out for measures directed toward fulfillment of the tasks placed before academy scientists at the 26th CPSU Congress and the 18th Estonian Communist Party Congress. The five-year plan for activities of the ESSR Academy of Sciences has taken into consideration all basic areas of fundamental research and solutions to problems of social-economic development. The presidium of the ESSR Academy of Sciences directs the activities of the academy toward improvement in scientific-research activities in institutes, the development of design and experimental work, expansion of the material base that is necessary for this, and the improvement in work conditions and daily life of scientists.

Further, K. Rebane touched on the more hopeful areas of development in present-day science and characterized the activities in the departments of the ESSR Academy of Sciences. The November (1981) plenum of the CPSU Central Committee, he said in conclusion, placed before the Soviet people tasks directed toward increasing the effectiveness of the economy, its intensification, and the fulfillment and overfulfillment of the 1982 plan and the five-year plan as a whole. This requires, from the scientists of Soviet Estonia, an increased role for science, more effective results in the activities of scientific-research and design organizations -- maximum concentration of effort on the most important areas of science, and we must work for this with still greater energy.

A report on the activities of the ESSR Academy of Sciences during 1981 and the plan of research for 1982 was given by A. Këërna, the chief scientist-secretary of the presidium of the ESSR Academy of Sciences.

The ESSR Academy of Sciences has been guided in its activities, noted the speaker, by the tasks placed before the Soviet people in the decisions of the CPSU for accelerating social-economic development and scientific-technical progress. The basic attention of the presidium of the academy, its departments, institutes, and organizations have been concentrated on the development of fundamental and applied research in urgent and prospective areas of present-day science, on raising effectiveness and quality of research, and on accelerated introduction of scientific-research results into practice. During the first year of the five-year plan, good results were achieved in all fields of science. The scientific activities covered 90 important problems. The development of 13 topics, including 7 scientific-technical topics, was carried out, and 31 proposals were introduced into practice. Among the more significant scientific-research results of the USSR Academy of Sciences, 30 works by Estonian scientists were noted. The activities of many scientists of our academy were highly praised. One of the USSR Academy of Sciences awards -- the gold medal imeni P. N. Lebedev -- for successes in research in optics and spectroscopy of solids and liquids was made at the yearly meeting of the USSR Academy of Sciences to K. Rebane, president of our academy and a corresponding member of the USSR Academy of Sciences, by Academician A. Aleksandrov, president of the USSR Academy of Sciences. Orders and medals were awarded to a number of scientists in our republic.

Further, A. Këërna spoke about research being done in the academy that has the most prospects and importance for science and the economy. The Institute of Physics has successfully continued work on the study of crystals and the improvement and further development of laser technology. The discovery of the phenomenon of hot photoluminescence in crystals has been entered in the USSR State Register; this has great significance for further research in optics and spectroscopy.

Joint efforts by scientists of the Institute of Physics and the Special Design Bureau of the ESSR Academy of Sciences have built a unique laser, designated for the conduct of scientific-research work in the field of laser spectroscopy and other scientific fields. A model of the laser was awarded a first-degree certificate by the USSR Exhibit of the Achievements of the Economy. Important results have been achieved by the Institute of Chemistry and Biological Physics in the field of research on the structures of solids. At the Institute of Cybernetics, automatic systems have been created for the control of large computer complexes. Projects in

the fields of energy and environmental protection done at the Institute of Thermal and Electrical Physics have great practical significance. There have been important achievements on the part of chemists in research on the synthesis of prostagladines and biotechnology. Results of this work are already being applied in health care and in increasing the productivity of livestock breeding. On the basis of research by geologists, survey and evaluation are being conducted on phosphorite deposits in Estonia and the status of underground water resources is being forecast. Projects at the Institutes of Zoology and Botany and Experimental Biology, and also the Tallinn Botanical Garden have been directed toward the solution of many problems that are a part of the food and environmental-protection programs being worked on. Now, when our country is preparing for the 60th anniversary of the formation of the USSR, work being conducted by institutes of the department of social sciences has special significance. This comprises the study of the history of the revolutionary movement of the Estonian working class, the patterns of establishing and further strengthening Soviet society, and the generalization of experience in international traditions and social achievements. Projects by economic scientists promote increase in the effectiveness of the economy and its intensification.

The characteristics of the scientific research results show that republic scientists have given basic attention to all-union and republic complex programs and to the accelerated introduction of practical results into the economy. Institutions of the ESSR Academy of Sciences have continued to work on nine republic complex programs, of which three -- "Preparational Biochemistry," "Complex Use of Oil Shales," and "Rational Utilization of ESSR Phosphorite Deposits" -- have been approved by the republic Council of Ministers. In connection with this, the activities of the Republic Council for the Coordination of Natural and Social Sciences under the presidium of the ESSR Academy of Sciences have been significantly livened up.

The strengthening of the physical base has continued -- a new computer center has been put into operation at the Institute of Cybernetics, and laboratory space has been expanded for the experimental plant of the Institute of Chemistry and Special Design Bureau of the ESSR Academy of Sciences. Publication activities have been conducted successfully.

This year, the academy collective will work on 94 urgent problems and 236 topics. Great significance will be attached to the participation of ESSR Academy of Sciences institutions in the development and implementation of complex scientific programs. The drafting of a regional program for scientific-technical progress to the year 2005 has substantial significance. Many scientific collectives of the republic are taking part in its development. Here, the Institute of Economics is the head organization.

The fulfillment of high-priority planned tasks, said A. Keerna in conclusion, requires the intensification of scientific-research work in all parts of the ESSR Academy of Sciences. He expressed confidence that, during the year of the 60th anniversary of the formation of the USSR, scientists will fulfill with honor the responsible tasks laid upon them and will make a worthwhile contribution to the further progress of Soviet science.

For services in promoting the organization of research in the field of natural sciences, the deputy chairman of the ESSR Council of Ministers, A. Gren, was awarded the memorial medal imeni K. Ber. Medals of the USSR Exhibit of the Achievements of the Economy were also handed out. Student prizes for 1982 were awarded to republic VUZ graduates V. Liyman and E. Kasak.

In the work of the annual meeting of the ESSR Academy of Sciences, there was participation by V. Vakht, secretary of the presidium of the ESSR Supreme Soviet, and A. Aben, head of the department of science and educational institutions of the Estonian Communist Party Central Committee.

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GEORGIAN ACADEMICIAN DISCUSSES S&T PLANNING AND DEVELOPMENT

Tbilisi ZARYA VOSTOKA in Russian 10 Mar 82 p 2

[Interview with N. Landiya, vice-president of the Georgian SSR Academy of Sciences by A. Mgeladze, correspondent of ZARYA VOSTOKA; date and place not specified]

[Text] Acceleration of the rates of scientific and technical progress stipulated by the decisions of the 26th CPSU Congress advances a number of the most urgent tasks to improve control of science, methods of long-term and current planning of basic and applied research. Consequently, the questions associated with forecasting the development of science and technology have become more important.

In conversing with the ZARYA VOSTOKA correspondent, Vice-president of the Georgian SSR Academy of Sciences N. Landiya examines a number of urgent problems in the development of science, scientific-technical forecasting and planning.

[Question] It is common knowledge that science is evolving because of two dialectical interrelated reasons. First, the self-evolution of science which occurs according to its specific internal laws. The second is the social demand and the social order. Which of them, in your opinion, nevertheless dominates and has the decisive effect on the trends and rates of scientific and technical progress?

[Answer] In the epoch of the scientific and technical revolution, science was transformed into a direct production force. The entire material and technical base of product was transformed. The human position was considerably altered, first in the production, and then in other conditions. This made it necessary to transform the structure of demands and the value orientations of man, the collectives and social groups. Therefore, in the scientific and technical revolution, the interaction of science and human needs is becoming much more complicated.

An international symposium took place in Tbilisi which covered precisely these questions. A conclusion was formulated during it that whereas the ideology of "pure" science had dominated until recently, which was then

replaced with a viewpoint of science as a direct productive force called upon to fulfill outside, social orders, now statement of problems and tasks linked to satisfying and developing human needs is placed directly on science itself. It was also noted that this function of science was previously formed in precisely the socialist countries where science is faced not with narrow utilitarian, but broad, socially significant problems.

However, it happens even now that at a certain stage, a separate scientific direction develops exclusively into a force of internal laws, and then mainly because of an external factor. In other words, the reasons seem to replace each other. There is usually a special transitional period, which, if the process of development is not controlled, can be extended for years. Consequently, many scientists have to spend considerable efforts on proving the urgency of the research. It has also been noted that it is generally much easier to obtain the green light for research with a clearly formulated goal. It is too bad that this is sometimes done to the damage of that research whose target purpose is defined in general features and the possibilities for realizing the discovery or new idea are latent. This approach can result in large miscalculations for predicting scientific trends and selection of the subject matter by individual groups and collectives.

[Question] What is the primary explanation for the increasing role of forecasting in modern scientific and technical conditions?

[Answer] This is first of all an increase in the complexity of the object of control, science. As already indicated, it has a new function associated with the development of human needs which has a forecasting nature. Scientifically substantiated forecasts help to avoid undesirable miscalculations and the adopting of unpromising solutions and plans.

The number and complexity of programs for social-economic development which vary in scale and goals are continually rising. There is consequently a rise in the need to improve their long range and comprehensiveness. The new discoveries also have a significant effect. They often force us to re-examine the already adopted and developed programs and plans.

[Question] Is it correct to assert today that the scientists can foresee fairly accurately the trends in scientific and technical progress?

[Answer] Certain laws of scientific development are currently becoming clearer. We are sometimes able to predict major discoveries in its basic areas. One can predict much more accurately the distance which the process of research is from the solution to the problem. Applied studies are planned with a greater degree of confidence in the reality of implementing a certain development, since one can see here better and more accurately the development trends, and control them to a certain measure.

[Question] A set of methods for forecasting has been developed by now. Some of them are based on logical resources and methods, others are mathematical. Which methods, in your opinion, provide the most reliable data?

[Answer] This depends on the object and the goals of forecasting. In the case of forecasting global and regional problems of the development of science and

human needs, in the most complicated case, one should consider it the most promising to use the method of system modeling developed in the Scientific Research Institute of Systems Studies of the USSR Academy of Sciences. Based on this method, the specialist are able to take into consideration a much broader circle of variables than in other models of global development suggested by foreign scientists. Methods of expert evaluations have recommended themselves well. There are also a number of special and fairly efficient methods used to predict individual events.

[Question] Which are the most characteristic shortcomings of the methods of scientific and technical forecasting, in your opinion?

[Answer] First, the original data can be unreliable and incomplete. This is a frequent phenomenon in forecasting science. Secondly, such a subjective factor plays a large role as the psychological situation. By having a set of data which are usually contradictory and subject to varying interpretation, the expert aligns them with his previously formed model or plan. In addition, the striving to be objective and uncompromising in their judgments and estimates pushes many, even the greatest expert scientists to the ultimate caution. From here follows moderation in their judgments of the predictable results. One an can hypothesize that many promising programs have not been developed precisely because of such restraint by authoritative scientists. It is strange that the deep knowledge of the scientist in particular questions, in one, comparatively narrow field of science often interferes with a precise forecast. In this case the depth of knowledge prevents the scientist from thinking through the problem in a complex. It transfers the specific nature of his scientific activity to the entire problem as a whole.

[Question] The scientific search infers a creative approach to its activity. If forecasting seems to prompt to the scientist the promising trend of research, then planning already obliges him to follow in precisely this direction. Does not planning of science paralyze the scientist to a certain degree?

[Answer] The disputes regarding tasks and functions of the planning of science, its methods and potentialities do not die out. In fact, many scientists believe that planning, and this means regulation of science, especially basic sciences, results in a decrease in the efficiency of scientific labor. At first glance this is reasonable. However, the function of planning is much broader. The scientist administrators are constantly faced with an acute problem of establishing optimal relations between the different categories of research, and this means, financing of their development as well. The situation is strongly complicated by the fact that many modern scientific problems develop at the junction of different sciences. Very recently, at the junction of biological and chemical sciences, for example, new trends developed: bioorganic chemistry, bioinorganic chemistry, molecular biology, biotechnology, etc.

At the same time, all of this does not imply uniform, even proportional distribution of the scientific potential, material and technical resources, etc. Even possessing broad potentialities, it is impossible to implemently equally intensive studies in all fields of science.

[Question] The attempt to not insult anyone in planning, generally produces the opposite effect, everyone is insulted.

[Answer] This is natural. Almost every scientific leader believes that the research conducted in precisely his scientific organization is more significant and promising, and this means, requires special attention. Forecasting precisely makes it possible to overcome this type of narrow-departmental approach to science which results in dispersal of financing, and the inefficient use of apparatus and equipment, and finally shallow subjects. This is why a certain number of of scientific administrators generally support the idea of considerably reducing the number of directions that scientific research follows, and broader use of foreign experience based on the acquisition of patents, licenses, finished items, and thus the conservation of time, resources, redistribution of scientific cadres, etc.

We need to plan science, however it is just as necessary to constantly improve the system of planning, even during the realization of the approved plans. By predicting the development of science, by selecting on the basis of the forecasts the directions for scientific research, and by placing these data into the comprehensive target plans, it is necessary to verify from time to time the substantiation, selection and the actual plans that were constructed on the basis of the selection.

A flexible plan is a plan that can be periodically corrected with regard for the outlined trends in social and economic life. This plan is more realistic than the most detailed rigid plans. Precisely then the plan becomes a reliable help to the scientist.

[Question] What measures are currently being taken in our country, and in particular in the Georgian SSR to improve scientific and technical and socioeconomic forecasting?

[Answer] We are focusing steady attention on the problems of forecasting. The Soviet school of forecasting has acquired considerable international authority in recent years. The decree of the CPSU Central Committee and the USSR Council of Ministers "On Improving Planning and Strengthening the Effect of the Economic Mechanism on Improving Production Efficiency and Work Quality," as well as the decree of the presidium of the USSR Academy of Sciences, USSR Gosplan and the USSR Gosstroy "On Organizing Development of a Comprehensive Program for Scientific and Technical Progress of the USSR for 20 Years" (by five-year programs) will serve as a special stimulus for further improvement in the appropriate methods. This program, in particular, contains a section "regional problems of scientific and technical progress" which includes comprehensive programs for scientific and technical progress and its social consequences for the union republics.

It should be noted that fulfillment of the forecasting developments for each union republic is characterized by specific features which complicate the task. Our republic as well has started development of a comprehensive long-range program according to them. A special decree adopted at the end of last year defined the main organizations which are responsible for developing

the program and compiling summary documents for the general forecasting lines: basic directions for the development of science, basic directions for scientific and technical progress in the republic's national economic sectors, scientific and technical progress as a whole for the republic and basic problems of socio-economic development of the Georgian SSR. This is respectively the Commission to Study Productive Forces and Natural Resources under the presidium of the Georgian SSR Academy of Sciences, the Scientific Research Institute of Economics and Planning of the National Economy under the Georgian SSR Gosplan, the Institute of Economics and Law of the Georgian Academy of Sciences. A republic scientific council has been formed for problems of scientific-technical and socioeconomic forecasting. This council includes 23 problem commissions which have been entrusted with developing the corresponding sections of the comprehensive program. They must define the scientific policy for the indicated 20 years.

The twenty-year forecasting plan is being compiled by five-year plans, i.e., contains the initial data for short-term forecasts. One can state that this work has been done in the republic for the first time on such a scientific level and with such scales.

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ANNUAL MEETING OF LATVIAN ACADEMY OF SCIENCES

Riga SOVETSKAYA LATVIYA in Russian 18 Mar 82 p 1, 3

[Article "Basic Directions"]

[Text] The annual general meeting of the Latvian SSR Academy of Sciences took place in Riga on 17 March. Prominent scientists, leaders of scientific research institutions and VUZ's, specialists of the national economy, and representatives of public organizations gathered in the conference hall of the academy building.

Among those present were Comrades A. E. Voss, I. A. Anderson, Ya. Ya. Vagris, Yu. Ya. Ruben, P. Ya. Strautmanis, E. M. Ozols. Deputy chairmen of the Latvian SSR Council of Ministers I. V. Bondaletov, V. M. Krumin', M. L. Raman, head of the section of science and educational institutions of the Latvian Communist Party Central Committee V. S. Klibik were there.

The annual meeting of the academy was opened by its president Hero of Socialist Labor A. K. Malmeyster. He noted that now when the Soviet people are preparing with enormous political and labor initiative for the 60th anniversary of the formation of the USSR, the scientists are striving to make an even more weighty contribution to the economy, social and cultural progress of the country. The party and government are showing daily concern for the development of science. One can be convinced of this in the example of our academy. Created under the Soviet power, it has become a major research center equipped with the most modern equipment.

Scientific schools and trends have formed in the republic which are very popular in the country and abroad. These, in particular, refer to the chemistry of biologically active substances, mechanics of polymers, magnetic hydrodynamics, and plasma technology. The academy maintains close ties with the scientists of all fraternal republics, exchanges achievements which become common property.

For example, the Institute of Organic Synthesis has concluded over 150 contracts for cooperation with scientific institutions of the country.

The leading scientific-organizational role of the Latvian SSR Academy of Sciences has grown. It not only coordinates in-house research, but also that conducted in the VUZ's, and sector scientific organizations. Among them are institutes of union subordination, different branches, institutions belonging to the

ministries of public health, agriculture, light industry, education and other departments. The current annual plan for the most important research on natural, technical and social sciences contains about 230 assignments. Many of them have a direct outlet to practice. We are striving to ensure an efficient combination of basic and applied search, focusing especial attention on urgent problems of industry and agriculture.

During the first year of the 11th Five-Year Plan, about 100 developments of the Latvian SSR Academy of Sciences were introduced into the national economy. Its collectives concentrated their forces on the main scientific directions which were defined by the 26th CPSU Congress. Now a new system of control over science is being formed which is based on the program-target principle and which stipulates specific schedules for realizing the obtained results. The academy participates in 31 comprehensive programs of union importance and 10 republic. All of this is an indication of the true growth of science of Soviet Latvia as a productive force.

The chief scientific secretary of the presidium of the academy, Hero of the Soviet Union V. P. Samson reported on the basic results of scientific activity of the Latvian SSR Academy of Sciences in 1981. Our basic task in the first year of the current five-year plan, he said, is reduced to further improvement in the efficiency and quality of research. Definite advances have been made on this path. They can be traced in the work of each scientific collective.

The Institute of Physics has achieved important results, continuing the study of the processes of heat exchange in a magnetic field. A set of highly productive units EMAGO (electromagnetic orientation) has been fabricated. These units have been sent to customers in different cities of the country, as well as foreign firms on licensed agreement. Research of the institute and its special design office was the basis for setting up a center for robot equipment. It will be involved in developing, fabricating and introducing many samples of industrial robots at republic enterprises. This cost-accounting organization is called upon to make a qualified resolution of the problem associated with eliminating manual labor at labor-intensive and monotonous operations.

Basic research leading to the construction of computer centers and systems has been developed by the Institute of Electronics and Computer Equipment. Its colleagues in recent years have been awarded the USSR State Prize, Latvian SSR State Prize, Gold Medal of the Leipzig International Fair, and eight medals of the USSR VDNKh [Exhibition of Achievements of the USSR National Economy].

The speaker further reported that scientists of the Physical-Energy Institute had completed many years of research on developing semiconductor transformers for railroad cars. The first passenger car with this transformer has been accepted by the state commission, put into operation and recommended for series production.

Research on solid state mechanics and polymers in the academy is becoming deeper and broader. The fundamentals have been laid for the theory of existence of polymers and composites, theory of their deformation and construction is developing, and effective replacements for biological tissues are being searched for.

Many of the problems to be solved are associated with improving reliability and decreasing the material-capacity of designs. According to the calculations of some organizations who are partners in the institute, each ruble spent on mastering its development will be compensated for by 6 rubles of saving.

Research is intensively developing on plasma chemistry. The colleagues of the Institute of Inorganic Chemistry and its special design and technical office who have suggested plasma technology for restoration and strengthening of machine and mechanism parts have noticeably advanced in this direction. This technology affords new potentialities for repair of textile equipment, road, construction and agricultural equipment. The parts which are restored by this technology are now being tested at republic enterprises.

Theoretical and experimental work in the area of organic chemistry, biochemistry and molecular biology have reached a high level. The Institute of Organic Synthesis is making a considerable contribution to implementing the all-union program "Prostaglandins," which is aimed at creating effective preparations for medicine and veterinary medicine. Its scientists have achieved special success in chemical "copying" of hormones from the peptide class. The use of one of them, oxytocin in animal husbandry has already provided over R 45 million of saving. The laboratory duplicate of another hormone, angiotensin is being studied as a drug for treating hypertension. It is remarkable that the analog of the natural bioregulator proved to be much more stable than the original which maintains its properties for only several tens of seconds. These studies have been awarded the USSR State Prize.

The biologists and microbiologists are answering directly to the demands of agriculture. Scientists, in particular, have proven the high effectiveness of the preparation kampozan which prevents lodging of different types of winter rye. Consequently, the grain harvest increases by 1.5-5 quintals per hectare. The innovation is now being used more widely in the fields of the kolkhozes and sovkhozes. It is used to treat crops on an area over 20,000 hectares. The laboratories have isolated new local strains of fungi which destroy certain types of insect pests. Technology for producing protein concentrates from vegetable raw material has been recommended.

Seven institutes of the academy are conducting research within the framework of the food program. The subject of their scientific search is very vast. It encompasses problems of conservation of raw material, fuel, electricity, improvement in the quality of products of agricultural production. The scientists are working on new growth and development regulators of field crops, optimizing the mineral nutrition of plants, and enriching the animal rations.

Agroindustrial associations have been organized in many regions of the republic according to the model developed by the Institute of Economics. This model is covered in two published books: the monograph "Experimental Agroindustrial Association," and the collection "Agroindustrial Complex. Improvement in Control." This is only one of the examples of the help given to the national economy by the institutes of the department of social sciences. They are studying urgent problems of history, philosophy, literary criticism, and investigating the material and spiritual culture of the Letts.

Fifteen archeological expeditions were outfitted last year. For the first time a 19th century house was reconstructed from the ancient structures previously found in the excavations of the lake settlement of Arayshi.

The youngest institute in the academy, philosophy and law, has published a number of monographs. One of them "Charles Scott in Latvia" (author Academician V. A. Shteynberg) has been awarded the prize of the presidium of the Latvian SSR Academy of Sciences. The Institute of Language and Literature imeni A. Upit has added four volumes to the academic collected works of Ya. Rainis.

The speaker characterized certain results of scientific-organizational activity of the academy. The department of physical-technical sciences has systematically monitored how the suggestions of scientists are introduced into the national economy. The department of chemical and biological sciences has focused a lot of attention on invention and patent-license work. The activity of the scientific council for semiconductors, the commission for scientific fundamentals of medicine has been noted. In the accountability year, the academy gave primary importance to strengthening ties between science and production. A new subdivision has opened up in the apparatus of the presidium, the section for scientific-technical development which is called upon to prepare annual and long-term plans of introduction, maintain constant contacts with different ministries, departments and enterprises.

Certificates of authorship and patents have been obtained for many pieces of research. Several new license agreements have been concluded with foreign firms. But this does not give us the right to stop at what has been attained. We have to mobilize the available reserves, achieve a reduction in the testing periods and more rapid industrial development of new technological processes, preparations, samples of equipment, and expand the sphere of their application in the national economy.

The time has come, the reporter said, to free the scientists of unproductive waste of time for collecting different types of information. Automated systems have been created for this. One of them has been operating for a long time and is bearing a perceptible benefit: it predicts the biological activity of chemical compounds. Another is in the works for searching for patent materials referring to medical chemistry. A republic information system has also been developed for economics, philosophy, sociology and other social sciences. In the future, these systems will be included in the unified computer network of the USSR Academy of Sciences and the Academy of Sciences of the Union Republics. Then all the collectives of the scientific institutions will have broad access to electronic information banks no matter where they are located.

In touching upon the training of scientific cadres, the speaker noted that a generation is now coming to the academy which will bring the Latvian science into the 21st century. The Institute of Microbiology imeni Avgust Kirkhenshteyn, for example, is constantly concerned about those who start on this path. Its young scientists are co-authors of serious scientific publications.

One of the most important tasks is to train cadres of the highest qualification. Unfortunately, it is impossible not to notice the distinct disproportion here.

In the last 6 years, 277 candidate dissertations have been defended in the academy, and only 27 doctoral. Thus, for every 10 candidate dissertations there is only 1 doctoral. We absolutely must keep up with the USSR Academy of Sciences where the optimal ratio is 5:1.

One cannot help but be concerned about the age of the dissertation authors. On the average they become doctors only by age 46, and candidates by age 35. Over 100 doctors of sciences are now working in the academy, this is fairly high potential, and needs to be more efficiently used to help the young group.

The results of the accountability year indicate that a lot has been achieved in the development of science and realization of its achievements. All the planned assignments and commitments have been fulfilled. The Institute of Organic Synthesis was the winner in the all-union socialist competition and was awarded the challenge Red Banner of the CPSU Central Committee, USSR Council of Ministers, AUCCTU and Komsomol Central Committee. The Institute of Physics which has distinguished itself in the socialist competition of collectives of the USSR Academy of Sciences and academies of the union republics was awarded the challenge Red Banner of the Presidium of the USSR Academy of Sciences and Central Committee of the Trade Union of Workers of Education and Science. Thirty-two colleagues of the academy have been awarded orders, medals, honorary certificates of the Presidium of the Latvian SSR Supreme Soviet.

The speaker expressed his confidence that the Latvian scientists will meet the renowned 60th anniversary of the Union of Soviet Socialist Republics with new achievements, and will aim their efforts at implementing the decisions of the 26th CPSU Congress.

Academician R. A. Kukayn, deputy chairman of the Latvian SSR Council of Ministers, chairman of the republic Gosplan M. L. Raman, Academician A. F. Krogeris, A. F. Blyuger, corresponding member of the Latvian SSR Academy of Sciences V. V. Pirogov, Doctor of Economic Sciences I. Kh. Kirtovskiy, Doctor of Physical-Mathematical Sciences Yu. R. Zakis, chairman of the board of the Talsy regional agroindustrial association V. Zh. Kleynberg, Doctor of Technical Sciences U. E. Viyestur spoke at the meeting.

Scientific reports were then heard. Doctor of Physical-Mathematical Sciences V. P. Tamuzh covered urgent problems of the mechanics of destruction of polymers and composites. Corresponding member of the Latvian SSR Academy of Sciences Yu. A. Bankovskiy discussed the structure and properties of complex compounds and their use in analytical chemistry. Corresponding member of the Latvian SSR Academy of Sciences Ya. Ya. Kalnin' spoke on the subject "Basic Trends in Developing the Lettish Soviet Literature."

The annual general meeting gave out to laureates diplomas for prizes in the name of the leading scientists of the republic.

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LITHUANIAN ACADEMY OF SCIENCES HOLDS ANNUAL MEETING

Vilnius SOVETSKAYA LITVA in Russian 27 Feb 82 p 1

[Article from EL'TA: "Important Tasks of Science"]

[Text] As already reported, the session of the general meeting of the Lithuanian SSR Academy of Sciences took place on 25 February. It discussed the work done by the republic scientists in 1981, as well as questions of integrating basic and medical sciences. The most important trends of scientific research for 1982 were reviewed.

The session focused a lot of attention on further strengthening of ties between science and production, theory and practice. One of the prime ways to improve the efficacy of the searches is to form and execute by the combined efforts of experimental and production associations comprehensive scientific-technical, economic and social programs. It is precisely this task which the 26th CPSU Congress placed before the scientific institutions of the entire country.

The scientists and production engineers of Soviet Lithuania are currently participating in resolving over 40 comprehensive programs, including 20 all-union. The departments and organizations of the republic are making their contribution to creating and improving energy equipment, chemicals and their technologies, medical equipment and preparations, electronic, semiconductor and laser instruments for automation of scientific research and planning, and for the protection of the environment. The comprehensive program for scientific and technical progress of the Lithuanian SSR for a lengthy period is being formed, and programs are being fulfilled to study the mature socialist society, the development of social planning and other problems of social sciences.

The broad scope of the work and the rallying of forces foster integration of different sectors of science, and strengthening of the ties between the institutes of the academy, VUZ's, other scientific organizations, industrial enterprises, ministries and departments. Last year the subdivisions of the Academy of Sciences concluded almost 300 contracts on scientific and technical cooperation with the organizations of Lithuania, fraternal republics, and scientific centers of the socialist countries. In the institutes of the academy and at the enterprises of various sectors there are 10 active interdepartmental laboratories, bases, shops which implement a continuous process of introducing scientific work into practice and reducing the path of the innovation on the "institute-plant" route.

The republic's first scientific-production complex "Elektronika" has been set up. It is headed by the Institute of Semiconductor Physics. It unites 12 scientific, educational and production organizations. The task of the complex is to create and introduce into practice basically new methods and means of automating production processes based on the latest achievements in the field of physics of semiconductors and mathematics.

The republic has formed yet another association of this type, "Pretsizionnaya vibromekhanika." Its base organization is the Kaunas Polytechnical Institute imeni Antanas Snechkus.

With the creation of these complexes in the republic, a new stage has begun in the integration of science and production, bringing the researchers even closer to the needs of the national economy.

Last year, over 100 works done by the academy were acknowledged as inventions. The thousandth invention of the academy scientists was recorded. The assignments for the economic effect from introducing scientific innovations have been considerably overfulfilled.

A separate meeting of the session of the general meeeting covered the strengthened interaction between the sectors of science, integration of basic and medical sciences. The results of the business cooperation between the specialists of mathematics and cybernetics and physicians were noted. Weighty work is underway in the Institute of Biochemistry to reveal the secrets of the cell, synthesize antitumor and antileucosis preparations.

At the same time, the need was stressed for strengthening the ties of physicians and the institutes of physics for broader use in medicine of lasers, electronic and semiconductor instruments, spectroscopy and ultra-acoustics. The chemists and specialists of other sectors must play a role as well. The all-union programs in the area of medical sciences in whose implementation the specialists of the republic Academy of Sciences, centers of medical science and industry participate promote the strengthening of these ties.

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UKRAINIAN SCIENTISTS ESTABLISH CLOSER TIES WITH PRODUCTION ENTERPRISES

Kiev RABOCHAYA GAZETA in Russian 12 Mar 82 p 2

[Interview with I. I. Karban, secretary of the Rovno obkom of the Ukrainian Communist Party, by A. Boychuk, leading engineer of the Ukrainian republic administration of the USSR State Committee on Standards: "The Working Force of Science; The Effect Should Be Real; The Republic Review of the Introduction of Scientific Achievements into Production"]

[Text] During recent years, party and public organizations and collectives of industrial enterprises of Rovenskaya Oblast have accumulated valuable experience in accelerating the rates of scientific-technical progress in the economy. This work has been especially active in connection with the republic review of the introduction of scientific achievements into production. This is discussed by the secretary of the Rovno obkom of the Ukrainian Communist Party, I. I. Karban.

[Karban] The essence of the relationships that have evolved in our oblast between industrial enterprises and scientific, design, and project-planning organizations is, above all, in interaction and dovetailing. Production enriches science with concrete, real problems that require solution today, now, at a given enterprise. Science itself always enriches practice. In this, if you will, is the dialectic of the scientific-technical revolution.

I will introduce an example. Recently, in our inter-sector center for scientific-technical information and popularization, there was a meeting of party-administrative and scientific-technical leaders of the city. In its work there was participation by scientists from L'vov -- representatives of the Western Scientific Center of the Ukrainian SSR Academy of Sciences. Before this, they had worked several days in collectives at a flax processing combine, a high-voltage equipment plant, and the "Azot" production association. They acquainted themselves on the spot with problems, the solution of which was beyond the capabilities of the producers. In short, at the meeting of the leaders, there was conversation not about random questions, but about a number of specific topics introduced into the plan for joint work by scientists and producers.

It is characteristic that, during recent years, the interest of research and academy institutes in establishing close relationships with enterprises has grown signifi-

cantly. Look at the "Azot" association itself. Very recently, in the presidium of the Ukrainian Council of Scientific-Technical Societies, with participation by representatives of the Institute of Economics of the UkSSR Academy of Sciences and UkSSR Gosplan, specialists of the Ukrainian Republic Administration of the State Committee on Standards, and a number of other republic organizations, there was generalization of the experience of the association in improving the administrative mechanism. In the scientific council of the All-Union Scientific-Research Institute of Standardization, there was an examination of a work program, at the base of which lay the experience of Rovno enterprises.

Undoubtedly, it was not accidental that scientists from the State Committee on Standards acquainted themselves with our experimental development and application of regional standards -- oblast, city, and rayon -- that provide for social-economic and production-technological "evening up" of enterprises of the most varied agency subordination. They saw the necessity for scientific understanding of our practice and scientific development of an idea. Well, and the enterprises of the oblast, naturally, were interested in having help from the State Committee on Standards in the intensification of the fight for effectiveness and quality.

[Question] In other words, the fight for effectiveness also presupposes a search for more effectiveness in methods for organizing such work?

[Answer] Perfectly true. In the 10th Five-Year Plan, frankly, we came up with low qualitative indicators. We occupied 19th place in the republic. But by the end of the five-year plan, we were among the leaders in the oblast.

I am convinced that if our production collectives were to follow approved routes in their development, they would also, of course, achieve very appreciable successes. Certainly, if the Rovno area were like the republic as a whole, the proportion of products manufactured with the Mark of Qaulity would increase by a factor of from 4.5 to 4.6. But we had an increase, during the past five-year plan, by a factor of 10!

What was the reason for this? The reason was the intensification of the methods of fighting for the best work quality. And the pioneer in this fight was the party organization of the oblast center. On its initiative, the principles of standardization for work quality improvement were applied not only in the basic production sectors, but also in organizations and institutions.

[Question] In distinction from other oblasts, the Rovno area has a regional quality control system, which has gathered together all lower systems, having combined them into a single regional complex. To the usual standards, we added city, rayon, and oblast standards, taking the specifics of the oblast into account: its economic, social, and demographic structure.

[Answer] To work well, not only are certain general principles important, but also particular ones.

Thus, for example, how can we hasten the process of implementing a new technological idea, a new method of work, or new scientific or technical data? How can we ac hieve maximum effectiveness in this? Or, how can we accelerate the exchange of new ideas, new technical finds , "horizontally," as they say, at the level of enterprises belonging to various economic sectors and agencies?

Our system of regional standards helps do this. We have created an oblast inter-sector center for scientific-technical information and popularization. This is a very sound organization, with its own information base, reproduction facility, exhibit and lecture halls, and competent specialists. This center is also entrusted with the task of coordination of projects being done by societal organizations -- scientific-technical societies, the All-Union Society of Inventors and Rationalizers, and the "Znaniye" society. In addition, houses of scientific-technical information, advanced experience, and quality have been created in all cities and rayons of the oblast and, it must be said, are operating very effectively.

[Question] They say that K. Sytnik, vice-president of the UkSSR Academy of Sciences, called the Zdolbunov House of Scientific-Technical Information, Advanced Experience, and Quality, a rayon academy of sciences!

[Answer] It was said with a certain amount of exaggeration. But a ruble spent to organize the work of these centers returns 12, 15, or 20 rubles in effect. At the same time, a saving is made directly by enterprises, kolkhozes, and sovkhozes. In a word, we think that the houses of scientific-technical information are a good thing. They fulfill an important missing link, the absence of which interferes with the creation of an orderly system for controlling the process of introducing scientific and technical achievements into production. It is their presence that will allow us to organize the republic review with a high degree of effectiveness.

In general, for many years, in the Rovno area, during June and July, a traditional review has been conducted of scientific-technical and everyday social status of enterprises. Competent commissions that include management leaders, highly qualified specialists of oblast, city, and rayon organizations, and party and soviet workers have thoroughly studied the state of affairs in each labor collective. Their conclusions and recommendations are legitimatized by appropriate decisions of party and soviet bodies. Then, very strict control is exercised over the fulfillment periods.

[Question] Republic ministries and agencies have increasingly begun to conduct scientific-technical seminars and schools at your Rovno enterprises . . .

[Answer] Just in the last six months, we have had republic meetings of the Ministry of the Meat and Dairy Industry, Motor Transport, Forest and Lumber Processing Industries, and others. They often come here to learn about our experiences. Representatives have visited us from Dnepropetrovsk, Dneprodzerzhinsk, Shchekino, and Cherepovets. These include delegations of people from leading sectors of heavy industry. They say that they find much of interest. For example, in the organization of casting production -- at the tractor-part plant -- we have a casting shop in operation that is equipped with the very last word in science and technology.

[Question] From your point of view, what must still be done so that science and production become more motivated to have more business-like contacts?

[Answer] At the November (1981) plenum of the CPSU Central Committee, Comrade L. I. Brezhnev insistently pointed to the necessity for changing the style of economic thinking. In this connection, I will introduce the following example.

In the "Azot" association, interrelations between the design bureau and production shops are being built on the basis of real cost-accounting. If, let us say, as a result of proposals by designers for modernizing machines and systems the output of finished products were to be increased, labor expenditures were to be decreased, and the use of raw materials and energy were to be made more economical, then a worthwhile addition to the wages would be calculated for designers and maintenance services on the basis of the collective coefficient of labor participation. From my point of view, the time has come for interrelations between academy, scientific-research institutes, planning-design organizations, and industrial enterprises also to be built on cost-accounting principles. Rewards should be allotted according to the economic effect produced on the basis of the coefficient of labor participation. It is necessary to avoid all possible conditional economic effects. Calculations should be made only on the economies really achieved.

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ROSTOV OBKOM ENTERPRISES MAINTAIN CLOSE TIES WITH SCIENCE COMMUNITY

Moscow EKONOMICHESKAYA GAZETA in Russian No 7, Feb 82 p 5

[Article by N. D. Pivovarov, secretary of the Rostov CPSU obkom: "Achievements of Science into Specific Actions"]

[Text] Acceleration of scientific and technical progress and the development of science as the foundation for this progress occupy an important place among the tasks of enormous scale set by the 26th Party Congress for the 11th Five-Year Plan. Comrade L. I. Brezhnev noted at the congress, "No one has to be convinced of the great importance of science. The party of communists starts from the fact that the construction of a new society without science is simply unthinkable."

The experience of our leading collectives shows that success in this area is more perceptible the more concern is shown for the unification of science and production, and the strengthening of the effect of progressive ideas on it. An important role in this belongs to those who create projects for construction and reconstruction of enterprises, who design the machines for the future. To make the most complete use of the latest achievements of science, technology and the leading experience today means to ensure a leading level of production for tomorrow.

In order to realize these tasks, the oblast party organization has great potentialities. It is enough to say that over 5,000 doctors and candidates of sciences, 122 scientific research and planning institutes, design offices where about 70,000 scientific and engineering-technical workers are employed are currently operating in the oblast. Over 450,000 highly skilled specialists are engaged in all the sectors of production. The oblast society of efficiency experts and inventors numbers about 250,000 in its ranks.

This is an enormous force if it is applied to specific tasks and is skilfully organized. The oblast party organization is aiming its efforts at this also.

Concentration of Forces

It should be said that the necessary work experience to strengthen the ties between science and production was accumulated in previous years. In particular, the oblast "Unified Plan of Industrial Enterprises, Scientific Research Institutes, VUZ's, Design Offices and Planning Organizations for Applied

Research, Development and Introduction of Their Results into Production" has been developed and implemented. It was the first experiment in a centralized and systematic influence by scientists on production.

The results of work to fulfill this plan have not stopped being influential. The Don scientists under the supervision of the North Caucasus scientific center of the higher school have made their recommendations for the technology of manufacturing parts and for the quality control methods for operations at "Atommash." The work of the scientists was very instrumental in helping the frontrunner of nuclear power machine construction to produce the first products ahead of schedule.

The production association "Rostsel'mash" has ties with many scientific research and planning design organizations. The majority of research and development here is done with the participation of the Rostov Scientific Research Institute for Technology of Machine Construction (NIITM) and the Institute of Agricultural Machine Construction. In recent years, the Rostov NIITM has done work at the enterprise to introduce 39 automatic lines for stamping parts from rolled products. This made it possible to completely eliminate manual labor, elevate its productivity four-five-fold, obtain a considerable conservation of metal, and improve the quality of the parts.

The Novocherkassk Polytechnical Institute has done major work for a number of oblast enterprises. The institute has developed and introduced about 20 topics for the Novocherkassk electric locomotive construction plant. Many of them were the foundation for the creation of the VL-84 electric locomotive for the Baykal-Amur Trunkline.

These are only some examples. If we look at the whole situation, then in the last 5 years, the scientists have made over 1,500 developments and research for oblast industrial enterprises based on accounting contracts and contracts for creative cooperation. The cost of the work done was over R100 million and the economic effect was about R 600 million.

In other words, with the direct and active participation of the scientific research institutes, VUZ's, planning-design organizations and the specialists of the enterprises, important tasks of further introduction into practice of the achievements of scientific and technical progress were solved. This made it possible to increase labor productivity, improve quality, reduce the labor intensity of the manufactured products, and solve certain social problems.

We have many other forms of applying major scientific efforts to specific work for implementing scientific and technical progress. This is also the experience of creating integrated creative brigades with the participation of scientists, specialists, worker innovators, and the further development of the famous valuable initiative "Engineering Support for the Worker Initiative," which has passed the test of time and has yielded a good economic effect, the defense of worker dissertations, and many other forms.

More Initiative and Responsibility

The Rostov party gorkom is approaching the resolution of questions of accelerating technical progress creatively and with initiative. Mass competition has been set up in the city under the motto "The Entire Increase in the Volume of Production without Increasing the Number of Workers, through a Rise in Labor Productivity." The city enterprises are fulfilling plans and working without laggers.

Questions of technical re-equipping in the city of Shakhta, questions of mechanization and reduction in manual labor in Taganrog and questions of improving product quality in Novocherkassk are being resolved in a business-like manner.

At the same time, to say today that we have achieved all that was planned means to err against the truth. The problems of strengthening the ties between science and production was the topic of discussion at the recently held plenum of the party obkom which analyzed the tasks of the party organizations in the oblast for further acceleration of scientific and technical progress, introduction into production of scientific developments and the leading experience in light of the requirements of the CPSU 26th Congress.

Analysis of the forms and methods for linking science and production revealed considerable reserves in the scientific and technical support for the fulfillment of the 11th Five-Year Plan assignments. Serious omissions of the economic leaders and party organizations and insufficient activity in questions of introducing research and developments on the part of the scientific collectives were noted. Not all the economic leaders show proper responsibility for the problem of technical re-equipping of the enterprises and do not always display a state approach to the use of the achievements of science and the leading practice.

In particular, lack of initiative on the part of the leaders of the association "Rostovpromstroymaterialy" in introducing the leading technology resulted in the fact that during the Tenth Five-Year Plan brick production only increased by 6 percent. This will in no way pay for the production outlays for reconstruction. The proper conclusions were not drawn from the requirements of the party obkom to ease the labor of women workers by the leaders of the Rostov chemical production association imeni October Revolution. The technology for production of ultramarine which practically eliminates manual labor and makes it possible to increase the volume of production which was developed by the scientists has not been introduced here. It should be noted that this technology was developed by the order of the association itself.

The party obkom has made serious claims against the scientific collectives who have still not become "disturbers of complacency." Their developments are not always the last word in science and technology.

The ultrasonic heads and control system for automatic lathes developed by the Rostov Institute of Agricultural Machine Construction for the plant "Rostsel'mash" have proved to be uneconomical, and over R16,000 of outlays were essentially cast to the wind.

A total of 712 research and development projects were completed in 1980 in the 24 leading institutes of the oblast, but as analysis has demonstrated, only every fifth one is superior to the known analogs in its level.

Our scientists do not always respond rapidly to the urgent demands of production. The oblast miners are experiencing an acute need for machines for comprehensive excavation of the thin anthracite beds with complicated mining and geological conditions , however the scientists of the Shakhta Scientific Research and Planning-Design Coal Institute are delaying the resolution of this problem. The scientists of the Novocherkassk Polytechnical Institute, which, by the way trains the cadres for the coal industry, is also not participating.

The scientists are still not working intensively on such problems as conservation of fuel and energy resources, construction materials, questions of automation and mechanization of manual labor, especially in auxiliary production, and in the service sphere. There is unsatisfactory work on the development and introduction of robot mechanisms and equipment. Such problems are being slowly resolved as introducing efficient technology for waste-free production, the use of secondary raw material, and conservation of metal.

We can unfortunately cite many of these examples. The party obkom has therefore required a drastic change in the attitude of all links of production control to the questions of scientific and technical progress, and has outlined efficient measures for strengthening the bond between science and production. The CPSU obkom office has approved a comprehensive plan for linking science and production for 1981-1985. The CPSU gorkoms and raykoms have been commissioned to take control of the formulation of these plans in all cities and rayons.

On Integrated Programs

An effective form for unifying all scientific forces to solve urgent specific problems for lifting the ecomony is the formulation of integrated target scientific and technical programs. We have created 11 of these programs. We were aided in this by the experience of the people of Leningrad and L'vov. The programs are aimed at resolving basic social and economic problems set before the oblast in the current five-year plan. Among them are "Atommash," "Powder Metallurgy,"Grain-harvesting Combine," "Transportation," agricultural programs and others.

For example, the program "Grain-harvesting Combine" has the goal of creating a highly productive grain-harvesting combine "Don-1500." The production association "Rostsel'mash" will execute this program together with the collectives of about 60 VUZ's, scientific research, planning-design and production organizations of different departments. "Rostsel'mash" has been given the functions of the work coordinator, while the supervision is provided by the program headquarters headed by the chief of the CPSU obkom section.

The system where a party headquarters is set up to supervise each program completely justifies itself, the more so under conditions where the executors of the program are subordinate to different ministries and departments. This

makes it possible to fuse the organizational interests of science and production and permits the economic unification of science and production with the approval of programs on the level of the ministries and departments that are involved in their realization. It is clear that it is easier for the headquarters to achieve this position than each enterprise separately.

Party control over the fulfillment of programs occurs at all levels, since their scientific and subject matter has been included in the plan for linking science and production of the enterprise, rayon and city.

The North Caucasus scientific center of the higher school has a significant role in the scientific support for the integrated target programs. They provide expertise and organize the fulfillment of scientific research outlined by the programs.

A Planned Base for Introduction

In examining the complex "science-production," it is impossible not to mention the problems which require resolution by the planning agencies, ministries and departments. To unite science and production "economically and organizationally" it is first of all necessary for the interested ministries to approve the integrated programs, for appropriate financing to be supplied through capital allocated for scientific research by the enterprises by whose orders the developments are being made.

In order to guarantee the unconditional introduction of scientific developments into production, it is necessary to place this process on a planned basis. The time has obviously come to include the research done by the VUZ's, scientific research institutes, and design offices by orders from the production associations and enterprises into the plans for new equipment. At the same time, rigid control will be set up over the expenditure of capital allocated to the enterprises for scientific research.

It is finally necessary to create a more advanced system for material incentive to the scientists and scientific workers for the introduction of the results of their research into production. The problem of developments is also very acute, especially those on the basis of economic contracts. This task is not being resolved today. The enterprises generally allocate funds for research, while the VUZ or scientific research institute is further forced to "supply" raw material and materials and scarce equipment themselves.

The resolution of all of these problems in combination with the program adopted by the oblast CPSU committee for improving the bonds of science and production will promote the fulfillment of socioeconomic tasks of the 11th Five-Year Plan and the realization of the decisions of the 26th CPSU Congress.

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UZBEK ACADEMY OF SCIENCES PRESIDENT ON DEVELOPMENT OF SCIENCE

Tashkent PRAVDA VOSTOKA in Russian 22 Mar 82 p 3

[Article by A. Sadykov, Hero of Socialist Labor, academician of the USSR Academy of Sciences, president of the Uzbek SSR Academy of Sciences: "The Leninist Train of Science"]

[Text] The Turkestan Eastern Institute was created in the difficult year of 1918. The Tashkent Leninist standard of science hurried through the glow of the civil war. The first group of professors and teachers from Moscow and Petrograd, armed with Lenin's decree concerning the creation of the Turkestan State University, arrived in Tashkent . . . .

Up to this day we recall with the greatest gratitude this historical train of science, the great educational mission of our Russian brothers. Now this train is gathering speed on the main lines of scientific and technical progress. As Leonid Il'ich Brezhnev said, the party has invested its most valuable capital in the matter of constructing socialism in Central Asia--the labor, talent and enthusiasm of its best workers. And the party has won this battle.

In terms of the absolute number of scientific workers Uzbekistan now holds fourth place, and in terms of individuals with a scholarly degree, third place in the country. More than half of the scientists of the republic are representatives of the local nationality. There are hundreds of scientific research institutes in Uzbekistan. More than 140 academicians and corresponding members, 900 doctors and more than 14,000 candidates of sciences are working here.

It was necessary to start from zero in the battle for cotton. But today the "white gold" of Uzbekistan has become a symbol and the material embodiment of the friendship of the Uzbek people with all peoples of the USSR.

Of course scientists could not stand to the side of this important state matter. Dozens of institutes are engaged in comprehensive study of cotton. In recent years all this research has been combined into a unified comprehensive program, "Cotton," and participating in its implementation are academies of sister cotton growing republics--Turkmeniya, Tajikistan and Azerbaijan. The isolation and introduction into production of strains of

the "Tashkent" group that are resistant to wilt have produced a great economic effect.

Through the efforts of scientists and designers new machines have been created for cotton growing. More than 60 percent of the crop that is raised is gathered with machines--this is a real revolution in cotton growing.

One can say with complete assurance that Uzbekistan has arranged and is successfully developing its own scientific schools for individual branches of natural sciences. There is widely known research in the areas of mathematical statistics, physical electronics, nuclear physics, solid state physics, mechanics and seismology. Interesting results have been obtained in biomechanic chemistry, and alkaloid and polymer chemistry, in the area of activation analysis and physical processes in semiconductor materials. Uzbekistan is constructing a unique solar furnace for producing especially pure refractory and fire-resistant materials. The work for obtaining and applying radioactive isotopes and radiation equipment are opening up new possibilities for the national economy, biology and medicine.

Eight special-purpose comprehensive programs have been approved.

Economists have developed the "Comprehensive Program for Scientific and Technical Progress and its Socio-Economic Consequences in the Future up to the Year 2000 for the Uzbek SSR." The main directions have been determined for the development of the Kashkadar'insk and Dzhizak territorial production complexes as well as the main directions for the economic and social development of Tashkent. The model has been developed for the interbranch balance of the national economic complex for an expanded list of branches.

During the years of the Tenth Five-Year Plan, 137 scientific and technical developments, about 140 assignments and more than 300 themes were completed. Client enterprises were given 486 work projects that were completed under economic agreements. There were 670 scientific proposals introduced into the national economy. The economic effect of the utilization of the academy's developments during these years amounted to 1.6 billion rubles. Each ruble invested in research was returned to the state five-fold.

A most important task of the republic academy of sciences in the modern stage is the acceleration of the introduction of completed research.

It is extremely necessary to the country that the efforts of general science, in addition to the development of theoretical problems, be concentrated more on the solutions to key national economic problems, on discoveries that are capable of making truly revolutionary changes in production. These are the words that Comrade L. I. Brezhnev used to present a clear-cut program for the development and practical embodiment of the achievements of science.

Our academy's scientific developments are oriented towards solving problems that arise from Uzbekistan's place in the unionwide division of labor and from the demands of the republic's development.

Comprehensive research on the utilization of cotton as a unique treasurehouse of various valuable substances will be of great scientific and practical significance. In this stage highly effective medicinal preparations with a broad spectrum of action, valuable supplements to livestock feed, and preparations for the construction and gas industry will be created in this stage.

A food program is being developed for the country.

In his report at the 26th CPSU Congress, Comrade L. I. Brezhnev said that today, looking forward to the next five or ten years, we cannot forget that it is precisely during these years that we are laying the foundation and creating the national economic structure with which the country will enter the 21st century. These works pertain to mineral and raw material resources as well. It is precisely during the 1980's that we will be laying the foundation and creating a new mineral and raw material base for the country, including Uzbekistan. To this end the republic academy of sciences will have to develop measures for increasing the efficiency of geophysical research, and also for developing direct, including geochemical, methods of prospecting. And chemical science is called upon to develop technological processes which will be able to ensure comprehensive and maximally complete utilization of raw materials and will prevent pollution of the environment.

Through the joint efforts of the scientists of Central Asia and Uzbekistan research is being conducted on the assimilation of the region's desert territories, the development of methods of fighting against wilt, seismology and earthquake-resistant construction, and social sciences. Joint work projects have been started for studying economic and social problems related to the diversion of Siberian rivers into Central Asia and Kazakhstan. Close bonds of cooperation link the Academy of Sciences of Uzbekistan with institutes of the USSR Academy of Sciences and the academies of the Ukraine, Belorussia, Lithuania and Armenia. Under the Eleventh Five-Year Plan the republic academy will participate in the fulfillment of 18 all-union programs in the most important scientific and technical areas which was approved by the State Committee for Science and Technology, and in 3 interdepartmental and 18 republic programs.

"Today it is no longer possible to discuss the achievements of Soviet scientists without taking into account the outstanding discoveries of our glorious national detachments of Soviet science," said Comrade Leonid Il'ich Brezhnev at the festivities for the 250th anniversary of the USSR Academy of Sciences. This recognition is one more piece of irrefutable proof of the triumph of the Leninist national policy because the essence of the dialectic of national relations in our country consists in complete unity of nations and nationalities, their fraternal cooperation and mutual understanding. This is why all union republics are greeting the 60th anniversary of the founding of the USSR with such enthusiasm.

Scientists of the Academy of Sciences of Uzbekistan are directing all of their knowledge and energy toward early implementation of the decisions of the CPSU Congress.

11772
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SCIENTIFIC-TRAINING-PRODUCTION ORGANIZATIONS BEING FORMED IN UZBEKISTAN

Tashkent EKONOMIKA I ZHIZN' in Russian No 12, Dec 81 pp 37-39

[Article by S. Sultanova, engineer: "A New Form for Integrating Production and VUZ's"]

[Text] The Fruzenskiy Rayon of the Uzbekistan capital can confidently be called scientific-industrial. Here there are many large industrial enterprises, scientific-research institutions, planning-design bureaus, and educational institutions. Individual VUZ's of the rayon today are already significant educational and scientific centers, where the training of highly qualified specialists is combined with serious scientific-research work, providing many practical results. It is gratifying that, from year to year, there has been an increase in the amount of work done under cost accounting by VUZ's directly responding to the needs of enterprises and organizations. Recently, there has been more widespread use of long-term agreements for creative cooperation between VUZ's and production. But cooperation, even on a long-term topic, is still not like close cooperation regulated by an organizational form of the most stable and permanent character.

Science today has become a powerful force for economic progress. Creative union of VUZ's, science, and production is the best route to increase production effectiveness and work quality. Full and rational utilization of the creative potential of scientists and the practical experience of producers create the most favorable conditions for accelerating scientific-technical progress and a reliable base for embodying in reality everything that is new and advanced.

A new form for the interaction of educational and scientific institutions and also industrial enterprises is the organization of educational-scientific-production associations (UNPO's), which are now becoming increasingly widespread. The high productivity of such an organization is evidenced by the more than ten-year experience of the association of the Leningrad Institute of Water Transportation with enterprises. The Leningrad Polytechnical Institute cooperates with the "Elektrosila" association. In Moscow, there is a UNPO that includes the "Serp i molot" plant, two VUZ's, three scientific research institutes, and a project-design institute. Moscow State University has solid contacts with the "ZIL" production association. Especially broad response and fame has been produced by the experience of the associations created by the Belorussian Polytechnical Institute with the Belorussian Automotive Plant and the Minsk Tractor Plant.

The "VUZ-science-production" system allows coping more successfully with many serious tasks, especially with scientific-technical tasks of a complex character. In such a union, the physical base is strengthened and financial capabilities are increased; scientific forces and practical means for introducing technical innovations are concentrated. Creative cooperation grows into practically more realistic and significant creative collaboration.

After carefully analyzing all the advantages of UNPO's, the bureau of the Fruzenskiy party raykom in Tashkent made a decision concerning the advisability of creating a civil educational-scientific-production association of the Tashkent Order of Labor Red Banner Textile Combine and the Tashkent Institute of Textile and Light Industries (TTK-TITLP). This UNPO was created and began operation at the end of 1979. In making the decision to create it, the party raykom proceeded from the assumption that it should respond to present demands for organizing scientific research and educational work and for strengthening ties between science and production and that it should facilitate growth in the effectiveness of research and development, their introduction into practice, acceleration of scientific-technical progress in production and, of course, significant increase in the quality of training for qualified production personnel.

Now, the separate scientific units and VUZ departments and laboratories that are connected with the training of specialists for the textile industry and engaged in scientific research in this economic sector are joined with the textile combine in a unified collective to solve urgent and complex problems. In this connection, the effectiveness of scientific research is increased as a consequence of concentrating material and financial resources, of expanding possibilities for the utilization, after development of new engineering and technology, the productive capacities of the combine.

The basic part of the scientific programs, as before, is determined by contractual topics. Earlier, however, scientists, including teachers, usually had to find sponsors for themselves and this meant, in a majority of cases, that it was quicker to reach an agreement when a short period was stipulated for producing final results. This led to an overabundance of topics, petty topics, shallow research, and a waste of efforts and resources. And, what was especially undesirable, relationships between the institute and production were insufficiently close.

With the creation of the UNPO, the possibility appeared for eliminating all these shortcomings, for applying the special-purpose program method of planning scientific-technical progress, and for providing a more rational and effective utilization of the means allotted for scientific research.

The educational-scientific-production association is putting together complex plans representing not a list collected from the "bottom up," on the basis of submissions by individual scientists, laboratories and, essentially, random topics, but a clear program of interaction among all three partners of the association.

On the premises of the Tashkent Textile Combine, branches were created of the basic departments of the institute -- spinning, weaving, and the chemical technology of fibers; branches of the departments of economics and the organization of the textile industry, materials, and others are preparing to open.

This form of cooperation between a VUZ and an enterprise will permit bringing the training of specialists into maximum conformity to the needs of practice and strengthening the purposefulness of this training.

As a rule, students are trained for three years within the institute, receiving the necessary theoretical training in fundamental sciences. Then, with the transition to the study of specialized disciplines, the character of the training changes. Study takes place directly at the enterprise, and students perform practical work in appropriate experimental sectors, shops, and laboratories.

In the branches of institute departments, specific engineering tasks are accomplished; the economics of the enterprise and the principles of production organization are studied. The students (and many of them are workers from this very enterprise) confront the real problems that face production. The subjects of course and diploma work, as a rule, originate from urgent production needs.

The community of interests of the development of production and improvement in the training of specialists is supported by joint conduct of civil-political measures, various scientific-practical conferences on the results of scientific research, sociological opinion studies, and vocational training for workers and specialists. These measures are becoming widespread among the collectives of the association. Cooperation has become so strong that the combine and the institute constantly approach one another for assistance with people, equipment, and instruments in the process of carrying out necessary projects.

It is well known that, unfortunately, new ideas enter the educational process slowly. At a plant, a student can be included in something from the moment of origin of an idea to its realization. This system of training, which organically combines class-room study with study directly at the plant and scientific-research work in laboratories, planning-design bureaus, and in shops, makes it possible to narrow the gap between educational programs and the newest discoveries of science and technology. As a result, an institute graduate has mastered the latest achievements in the field of knowledge that he will work in.

Thus, the tasks of the TTK-TITLP association are as follows: the intensification of production processes and improvement in the technical-economic indicators of production activities; the strengthening of the cost-accounting foundations of production management; the improvement of the organization, the methods, and the whole process for training specialists in higher schools, and also the raising of industrial personnel qualifications; the strengthening of effectiveness of the social-economic consequences of scientific-technical progress; and close and firm union of VUZ's and science with production.

Organizationally, the TTK-TITLP association is as follows: Proceeding from practical possibilities, the association apparatus is structured on nongovernmental foundations, and the material basis for its activities is provided entirely on cost-accounting bases. The position of the UNPO provides for the accomplishment of association management according to the principles of joint discussion and solution of all problems. An association council and a working group that works up issues for examination by the council have been created.

It is natural, here, as in any new activity, that difficulties and various types of vagueness are encountered. For everything to get on the right track and to begin to yield results, more time is needed, and it will be necessary to study all aspects of the first experience and to introduce, on this basis, whatever adjustments that are necessary.

But even now, it seems to us, it is possible to recommend starting the organization of educational-scientific-production associations, enlisting other VUZ's and industrial enterprises of the republic.

In any event, it is possible to say, with confidence, that the work begun in the creation of such associations is one of the effective means for the organic union of the achievements of scientific-technical progress with the advantages of the socialist system in the interests of further successful accomplishment of the social-economic programs for building communism.

9645
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GREATER ATTENTION TO SIBERIAN NEEDS BY SIBERIAN SCIENTISTS URGED

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA OBSHCHESTVENNYKH NAUK in Russian No 1, Issue 1, Jan 82 pp 58-64

[Article by A. V. Yevseyenko and G. A. Untura: "Some Problems of the Management and Use of Regional Scientific Potential"]

[Text] Novosibirsk is already one of the largest regional scientific and technical centers which is accumulating the scientific research and educational potential of the institutions and organizations located here for the solution of many of the scientific and technical problems both of Novosibirskaya Oblast and the whole of Siberia and of other regions of the country.

The scientific potential of Novosibirskaya Oblast includes basic and applied research, planning and designing and technological development work, and experimental and testing work. In addition, organizations which provide for all of the stages of the science-production cycle are located in Novosibirsk, which makes it possible to trace within a single region the movement of the results of basic research toward a real technical and economic change in production.

First of all, let us characterize the basic elements of the oblast's scientific potential. More than one-third of Siberia's scientific research potential and more than two-thirds of the potential of academic science is located here (Table 1).

In recent years a large number of experiments have been carried out in Novosibirsk on improving the organizational methods of transmitting scientific results into practice. The experience of the Siberian Branch of the USSR Academy of Sciences is, of course, of especial interest; however, in the present article we shall not perform a detailed analysis of all of the forms of the connections between academic science and production, but will examine these forms in the context of an analysis of the organizational forms and methods of directing the transmission of scientific results into practice. This aspect of the analysis seems to us to be the most interesting, since we agree with those researchers who write that the conditions have ripened for a further division of labor in the sphere of science in the form of singling out the third stage of the functioning of science--the introduction of the results of scientific research into social practice.

TABLE 1

Novosibirskaya Oblast's Share of Siberia's Scientific Potential, Percent

Indicator	1975	1979
Number of people employed in science and scientific services	35.3	37.3
Including: Scientific workers	34.0	33.5
Number of people employed in Siberian Branch of USSR Academy of Sciences		
Including: Scientific workers	57.7	59.5
Of them		
Doctors of Sciences	70.8	64.2
Candidates in Sciences	62.2	63.8

An analysis performed by us as a result of a special survey of the existing distribution of the results of the work of Novosibirsk's institutes, designing bureaus, and Vuzes has shown that while there is a considerable gravitation by these organizations toward Siberian problems, the proportion of research performed for other territories remains very high. Thus, during the 10th Five-Year Plan the proportion of topics on Siberia and the Far East in the total amount of the scientific research work of the city's 14 Vuzes came to 42 percent (including 25 percent in Novosibirskaya Oblast). Consequently, around 60 percent of the scientific research work was performed by Novosibirsk Vuzes for the European and South Asian parts of the country.

Branch and planning institutes are characterized by a stronger gravitation to work on the economic problems of Siberia as a whole; however, the problems of Novosibirskaya Oblast are, in our view, clearly not given sufficient attention. In the field of a retrospective analysis in order to elucidate the objective conditions for the use of special-purpose programmed methods of planning and managing scientific research work and introducing it in the region we singled out six special-purpose groups of scientific research planning organizations, designing bureaus, and Vuzes on the basis of the characteristics of the closeness of the themes of the work performed by them.

As the analysis of the individual special-purpose groups of scientific and planning organization shows, Novosibirskaya Oblast possesses a unique possibility for the formation of the full research cycle: from the scientific discovery to the introduction of the finished development work.

However, at the present time the contacts between the scientific and planning organizations of the different departments in Novosibirsk have a very limited character. The existing system of branch planning and management determines the type of interrelations through the head scientific research institutes of the branch and the corresponding subdivisions of the ministries on the basis, of

course, of branch interests. However, in substantiating the necessity for creating a new branch institute or the affiliate of some institute the existence of a large number of scientific and technical tasks precisely in a given territory is always put in first place. According to certain incomplete data, more than 80 percent of the scientific and technical work which was performed for city enterprises during the previous five-year plan was provided from outside, primarily from the country's central areas, and the local scientific and planning organizations which study the problems of such complexes as "Natural Resources," "Power Engineering," and "Socio-Economic" perform approximately the same amount of work for organizations in other areas of the country, including the center. And this under circumstances when the structure of scientific potential to a large extent corresponds to the economic structure of an oblast.

The reasons for such a situation seem to be diverse.

First of all, the historically determined siting of the scientific and planning subdivisions (almost all of the organizations which study the problems of the "Natural Resources" Complex arose at the time when Novosibirsk was the center of the West Siberian Economic Region and intensive searches for petroleum, gas, coal, and other minerals had begun in Siberia).

Secondly, the large share of economic contractual topics in the overall amount of the work performed (especially with planning institutes) frequently compels the conclusion of contracts with those clients who at the necessary moment have the appropriate funds. And for this reason these orders are often in no way Novosibirsk orders.

Thirdly, many of the scientific research institutes which are located in Novosibirsk are the head or the branches of the head institutes of a branch, and although at the time they were created it was assumed that Siberian problems would be solved, at the present time their topics to a large extent have an all-union character and envisage the corresponding geographical use of results. This is especially clear from the examples of the problem complexes "Power Engineering," "Transportation," "Industry and Industrial Construction," and "Agro-Industrial Complex."

Fourthly, the branch institutes perform work in the first place for the organizations of their branch and for this reason it is natural that the Novosibirsk organizations of this same branch cannot load them up with permanent amounts of work, while the inclusion in their plan of organizations from a different branch (close in profile) requires agreement on the ministerial level. It is apparently for these reasons that the scientists who work in Novosibirsk Vuzes conclude only 20-25 percent of their economic contracts with Novosibirsk enterprises and organizations.

Thus, the conclusion can be drawn that the development of its scientific and technical potential puts the city of Novosibirsk among the country's largest scientific and technical centers.

In order to obtain the most rapid real results from the science-production cycle it is necessary to have a highly industrialized introduction base in the region which at the present moment has already received a definite development in the system of the Siberian Branch of the USSR Academy of Sciences and in two divisions of branch academies (the USSR Academy of Medical Sciences and the All-Union Academy of Agricultural Sciences imeni Lenin), and also of scientific and technical organizations and departments.

A characteristic tendency of the contemporary development of science is the increasing complexity of its problems. Their solution now requires not only the coordination of the efforts of various research institutes, but also the inclusion in the work of the scientific and technical potential of industry. At the present time the Siberian Branch of the USSR Academy of Sciences has 19 long-term cooperation agreements with key industrial ministries which have been approved bilaterally by the Branch's leadership and the leadership of the corresponding ministry.

The scientists of the Siberian Branch have developed a systems approach to the problem of introduction which is based on the principle of "production for the branch." The transmission of scientific results into practice occurs in close and active cooperation with the large enterprises and organizations of the ministries which subsequently take upon themselves the responsibility for their dissemination to other enterprises of their branch, and together with the Branch's institutes they also train the appropriate cadres. Another important channel for moving the development work of scientists into production is the system of branch scientific research institutes and designing bureaus which have been created near the Novosibirsk academic town.

Most of the scientific and designing institutions of the Siberian Branch are engaged in long-term cooperation programs. By taking active part in the solution of important scientific and technical problems for one or another branch, the academic institutes and special designing bureaus obtain additional possibilities for strengthening the economically most important scientific research directions with cadres and equipment and for using the production operations base of enterprises at the concluding stages of scientific development work. As the scientific research work stage is being successfully concluded (for one or another topic of the coordination plan), among the co-executors from the branch, in addition to scientific research institutes, there is the inclusion of the branch designing bureaus with their experimental production, and also of industrial enterprises.

The improvement and creation of new materials, technologies, and equipment is at the basis of the Siberian Branch's cooperation with the branches of the economy. An important place, for example, is occupied by work on the automation of production processes and of scientific experiments, and on the extensive use of computers in all of the branches of the economy.

A special form of direct production by academic science "for the enterprise" is represented by creative cooperation contracts between the institutes of the

Siberian Branch and industrial and agricultural enterprises and construction organizations. At the present time such contracts have been concluded for the solution of concrete economic problems with several Novosibirsk plants and organizations and sovkhozes.

It appears that this form of relationship partially compensates for the inadequate amount and quality of the work of the specialized applied and introduction organizations in a branch. While they take a part of the work of a non-academic character upon themselves, the institutes with a theoretical profile are at the same time unable to constantly work on it since there exist their own programs of basic research which demand intense work from the entire scientific collective of the institutes. The practice of the constant increase in the amounts of economic contract topics in the academic institutes can hardly be recognized as useful, since the use of the potential of academic science for types of work which are objectively not characteristic of it diverts resources from the solution of theoretical problems. At the same time, creative cadres and resources can be found in the branch institutes and scientific and technical services of Novosibirsk's enterprises for bringing ideas to the level of solutions and models ready for introduction. But in order for this to happen during the 11th and subsequent five-year plans it would be expedient to improve the introduction base without whose normal functioning the work of any scientific and technical center cannot be recognized as effective.

It is important to emphasize that in every complex of problems which has been singled out by us on the basis of closeness of purpose there are organizations in which one of the chief functions is the practical introduction of ready development work and plans (most frequently not of its own organization) on the kolkhozes and sovkhozes and at enterprises and construction projects. Thus, the scientific potential of Novosibirsk can be supplemented by a serious introduction potential.

In our view, given the ever increasing limitations in the financing of scientific work, the most important thing is the comprehensive strengthening in the planning and even in the branch institutes of the introduction services. In addition, it is necessary to sharply strengthen the material and technical and cadre provisioning of a few introduction organizations and to attempt to supply them with orders from enterprises and organizations in Novosibirskaya Oblast. It is important to understand that the introduction of a new development concerns an entire complex of problems, beginning with technical ones and ending with social ones, and this means that it is a very complex matter whose realization is only posssible with a professional approach, and not on the basis of the enthusiasm of individual leaders or development workers.

In order to introduce finished development work it is necessary to create special organizations for which introduction will be the final result of their work. In the scientific literature the work of the "Fakel" Scientific-Production Association which is attached to the Sovetskiy Raykom of the Komsomol is quite frequently characterized as an example of the successful organization of the introduction process.

The organizers of the "Fakel" set the following goals for themselves: the performance of overall research (with the enlistment of specialists from the most diverse scientific and technical fields) on new scientific directions which have only just arisen for the realization of which there are no formed collectives; an acceleration of the process of the introduction of the research developments of the Siberian Branch of the USSR Academy of Sciences into the economy by means of bringing them to the level of trial semi-industrial models and methodologies; a wider involvement of scientific workers in the sphere of the introduction of the results of scientific research into the economy; and an increase in the operational time of unique experimental equipment.

It should be immediately emphasized that "Fakel" was in an exceptional position for the realization of these goals--surrounded by the rapidly developing scientific research institutes of diverse profiles of the Academic City and of Novosibirsk State University. Insofar as the payment for the work of the associates was performed on a basis of individual labor accounts and bills, the possibility was created for selecting quite qualified cadres.

The following data speaks of the dimensions of "Fakel's" work: In 1970 the "Fakel" Scientific Production Association performed in the year work worth more than 4 million rubles on 242 economic contract topics in 8 directions, with the total number of workers in "Fakel" in 1970 exceeding 6,000 people. The geography of its orders is a curious and important characteristic of "Fakel's" work. (Table 2)

TABLE 2

Territorial Structure of the Orders of the "Fakel" Scientific Production Association, 1970.

Region	Number of Topics	Amount of Scientific Research Work in Rubles	Percent
Western Siberia	107	1 615 990	40.1
Including:			
Novosibirsk	77	1 107 810	27.5
Eastern Siberia and the Far East	21	377 610	9.3
Central Asia	9	66 180	1.6
European part of USSR	105	1 972 597	49.0
Including:			
Moscow and Moskovskaya Oblast	42	914 790	22.8
TOTAL	242	4 032 377	100

The rapid growth of the recognition of and confidence in "Fakel" from economic organizations was a result of the authority of the Siberian Branch of the USSR Academy of Sciences which practically from its first steps (October 1966) supported the new organization. One of the basic reasons for the success of "Fakel" was in its extra-departmental nature--it is precisely this circumstance which made its work mobile; the overall research groups which were created for the realization of some topic immediately dispersed after the performance of the work. In this case it was ensured that ineffective or obsolete methodologies and approaches would not exist for long, which created the organizational preconditions for the introduction of the latest scientific achievements.

The basic part of the work performed in the scientific production association was connected with the development of various methodologies, instruments, and apparatuses for its own scientific research. This work could be performed on the experimental base of the appropriate client-organizations, that is, scientific research institutes.

An analysis of the experience of this kind of organization shows that within the framework of centralized planning and management its juridical position cannot be stable. However, the high level of work results of an introduction company which has an extra-departmental position and its substantial social resonance point to the necessity for seeking ways to "write" this kind of organization into the existing economic structures without the loss, of course, of its virtues. It seems to us that the local Soviets of Workers' Deputies (under the aegis, for example, of the planning commissions) have the objective possibility for organizing such forms.

This kind of organization, in addition, could take upon itself the functions of coordinating the actions of the scientific and planning organizations located in a region with respect to the solution of the given region's problems.

It is precisely in order to increase the responsibility of scientific research, designing, and planning and designing organizations for their final work results at all stages from scientific research to the introduction of its results into production that a shift by these organizations has been planned to a cost accounting system of the organization of the work to create, master, and introduce equipment on the basis of schedule orders.

If we are to speak about the realization in a region of the research-development cycle, then this condition should have the least to do with the obligatory inclusion of the basic sciences and the most with the inclusion of applied development work.

The solution of regional problems by the forces above all of local institutes does not at all mean that lagging plans and solutions will be selected and realized. The existence in Novosibirsk of a large scientific potential determines the high level of development work. The problem is that with the existing system of planning and managing scientific research work there is practically no real managerial mechanism for the transmission on the regional level of the completed development works of academic institutes to branch and planning institutes.

At the present time the departmental disunity of Novosibirsk's scientific and technical potential is making a special problem of the necessity for the coordinated interaction of the scientific research institutes and designing bureaus and planning institutes and Vuzes within an individual region.

Apparently, this kind of coordination under the existing system of planning and management can only be carried out with the help of a special regional scientific and technical program (in the case of the existence of a general problem for the region), or by means of the creation of a single managerial agency on the regional (for example, oblast) level. Since the creation of a special administrative unit which carries out the full overall management of scientific and technical work is impossible on the regional level, we can probably speak then about the coordination of the work of scientific research and planning organizations on solving the problems of Siberia and, especially, of Novosibiriskaya Oblast. For Siberia as a whole the role of coordinator for all types of research is being assigned to the overall program "Siberia" which was developed by the Siberian Branch of the USSR Academy of Sciences. The "Siberia" program is a program of basic research and, for this reason, for Novosibiriskaya Oblast a kind of organizational analog to this program is now being created which unites basically the work of non-academic organizations because it is precisely the results of their research that are the basis for the reequipping of production. As an analysis has shown, very insufficient use is being made of these results in Siberia and, especially, in Novosibiriskaya Oblast.

There is no doubt that it is necessary to take account of the extensive potentialities of the academic institutes of the Siberian Branch of the USSR Academy of Sciences, including with regard to the performance of applied development work; however, it should be remembered that the task of basic science is the investigation of the most general problems in the different fields of knowledge, while practical workers are interested above all in finished development work which can be introduced directly into production.

It is also necessary to take account of the fact that the work of the multi-level institutes of the Siberian Branch is directed by a single managerial agency--the Presidium--and it is able to coordinate the interaction with the institutes and organizations of other departments which arise in the region for all of its own institutes. For this reason, the most difficult thing is the overall regional management of the work of the scientific and planning organizations of the different ministries and departments (even within the framework of research and plans being carried out for the region).

Taking account of the existing regional difficulties which are engendered by the branch management of scientific research work, it is possible to formulate some sufficiently general principles of the functioning of an informal regional managerial body which would make it possible to take account of the interests of a branch and of a region in a more coordinated manner.

The managerial body should, first of all, create an information system which makes it possible to accumulate complete information on the current and future work of

all of the categories of the city's scientific research and planning institutes, design bureaus, and Vuzes. This information should contain a description of the finished development work of organizations for which it will be necessary to create a library of development work ready for mastery. In addition, a very important element of the search system has to be a detailed description of the basic directions of the work of these organizations, and also a list of the existing and planned for the future work partners of each organization.

Secondly, there has to be accumulated in the managerial body in the form of orders or expert appraisals of the needs of the enterprises and organizations of a city, oblast, or kray information about scientific and technical development work which is already being carried out or introduced at a given enterprise. This is important for ensuring a systems approach to the scientific and technical reequipping of production. When there is a satisfactory buildup of this kind of information it becomes objectively possible to establish practical relations within a region. Expert commissions deliver their recommendations on the possible distribution of orders.

However, this stage can be considered to be only a preliminary stage because it, in essence, is the pre-planning basis for a possible plan for a performance of development work on the problems of the region.

At the following stages the managerial body jointly with the leaders of the scientific organizations of the complex attempts to bring about the inclusion of its development work in the state plan of these organizations (this has to be proven in the appropriate ministries and departments). An analysis of the interrelations of the scientific organizations of the city of Novosibirsk amongst themselves and also with other enterprises and organizations shows that the planning of resources for the performance of scientific and technical work by enterprises is almost uncoordinated with the possibilities of the scientific and planning organizations in the region. For this reason, one of the tasks of the presumed managerial body has to become the coordination in time and in resources of possible contacts in the region.

As an analysis shows, an expansion of scientific organizations is the result basically of the internal needs of a branch itself and frequently is not coordinated with the existing needs for development work of the region itself. What are the negative consequences of this phenomenon? Since science and scientific services until recently did not belong in the sphere of material production and basically were financed from the budget, the capital for the construction of housing and cultural and domestic facilities was allocated for scientific research and planning institutes as a last priority. Thus, the creation of a new institute or the expansion of an old one gave rise to an overflow of workers from the previously created organizations or, most often, from the production sphere. We are not analyzing now the reasons and motives for this kind of overflow; however, it is clear that this process is capable of stripping bare also organizations which are engaged in the direct solution of regional problems.

In this connection, the proposal can be put forward in the form of raising the question with regard to a certain mandatory "scientific quota" and "scientific" contribution by the branches to the development of a region in the same way that the branches allocate investments and other share capital for the development of the region.

The thematic character and the amount of resources for these purposes could be determined by special expert commissions on the basis of the information which was discussed above. Control over the mandatory inclusion in the plan of an organization of topics concerning the scientific and technical needs of a region and their performance and introduction is also realizable either from a single regional agency, or within the framework of the Councils on Regional Programs which were mentioned above.

This kind of work has been performed since 1979 under the direction of the Council for Assistance to Scientific and Technological Progress attached to the Novosibirsk Obkom of the CPSU which has to a substantial extent taken upon itself the functions of the regional coordination of scientific work of an applied and planning character, which makes it possible to regard this Council as an analog to the managerial body being proposed in the article.

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EDITORIAL REPORTS

EXCHANGE AGREEMENT REACHED BETWEEN TBILISI, U.S. UNIVERSITIES

[Editorial Report] Tbilisi KOMUNISTI in Georgian on 25 February 1982 pag 3 carries G. Samsonadze's 1200-word interview with Tbilisi University Rector Vazha Okudzhava, who recently returned from Lowell University in Massachusetts, where an agreement was drawn up expanding the current exchange program between the two schools. Up to now, only a few individual teachers took part. Now the two schools will collaborate actively in several fields of scientific research, including polymers, theoretical and applied physics, ecology, and hydrobiology. Even though the U.S. government has tried to thwart such contacts, American scholars are enthusiastic. In addition to its benefits to scholars and students, the program should foster a "better political climate" between the two countries. There is also hope that a similar agreement can be drawn up with the University of Massachusetts in Boston.

Okudzhava's own specialty is general and cell neurophysiology, with particular application to brain disorders including epilepsy. He is a member of a UNESCO body dealing with such matters, and is responsible for organizing an international symposium in Tbilisi next October in which Americans will take part.

GEORGIAN BIOPHYSICIST URGES STEPPED-UP EFFORTS

[Editorial Report] Tbilisi KOMUNISTI in Georgian on 13 December page 2 carries a 2800-word article by Prof B. Lomsadze, head of Tbilisi State University's Biophysics Department [kafedra], on Soviet--and particularly Georgian--efforts in various crucial new fields of theoretical, experimental, and practical (economic) biology, now and in the future. The piece comes under the recurring rubric "Prior to the GCP CC Plenum," and makes specific reference to two CPSU CC and USSR Council of Ministers decrees on the subject, one from 1974 and one from 1981; the latter deals specifically with "physical-chemical biology," which is the main focus of the present article. Lomsadze goes into some detail on the substance of that particular branch--what it seeks to understand of biological structures and functions in plants and animals--and how such understanding and the techniques that grow out of it can be applied to practical problems in industry, food production, medicine,

energy (oil), etc. With respect to Soviet (and Georgian) capabilities, he quotes Academician I. Ovchinnikov's recent remarks concerning the USSR's lack of an adequate material-technical base and, especially, the urgent need for trained specialists. Lomsadze discusses Georgia's training centers and facilities, in particular the university, noting that it takes from 10 to 12 years of higher education to train such specialists. He mentions the practice of sending Georgian students to Moscow State University for relevant training and has some brief suggestions on strengthening Georgia's own base.

CLOSER LINKS NEEDED BETWEEN GEORGIAN AGRICULTURE SCIENCE, PRODUCTION

[Editorial Report] Tbilisi KOMUNISTI in Georgian on 11 May 1982 page 2 under the current rubric "Prior to the Sixth GCP CC Plenum" carries a 4100-word article by V. Mdivani, chief of the Agriculture Ministry's Science and Propaganda Administration, concerning a number of general and specific problems hampering closer, better coordinated, and more productive links between agricultural science and production. A persistent problem is that the production units often fail to put innovations and scientific recommendations into production. On the other hand, the research institutions too often deal with petty and discoordinated themes, a situation aggravated by long delays in getting the findings to the ultimate users--for one thing, the sector lacks its own publication base, and information moves too slowly. The research institutions are also hampered by an inadequate material-technical base and by shortages or disproportions in specialist cadres (moreover, specialists with higher degrees are aging and not being replaced with younger cadres). One passage deals with the disappointing performance of the republic Center for Scientific Organization of Labor [NTO] and Administration of Production, which is understaffed, poorly housed and has little impact on the work of the few local NTO councils. In general, the author's recommendations concern moves to ensure better coordination both on the research-and-development end and on the adoption-into-production end.

WORK OF GEORGIAN CONTROL SYSTEMS INSTITUTE

[Editorial Report] Tbilisi KOMUNISTI in Georgian on 8 May 1982 page 2 carries a 1700-word article by Professor Doctor of Technical Sciences M. Salukvadze, director of the Control Systems Institute, concerning that institution's contributions to science and the economy, with heavy emphasis on computer systems and applications. The institute consistently meets plans and targets and makes a profit on its work. In addition to budget projects it does contract work for various clients. Salukvadze notes, however, that his institute's contribution could be even greater if clients were more enthusiastic about actually putting completed projects to work (many neglect to do so), and he proposes that legislation be enacted to force them to do so as well as to take part in determining the economic effect of application over the long term. Inter alia, the institute is developing speech recognition systems as well as natural-language (written Russian) man-machine dialogue systems, and the creation of fourth-generation computers is in process.

GEORGIAN INTEGRATED SCIENCE-PRODUCTION FACILITIES EXTOLLED

[Editorial Report] Tbilisi KOMUNISTI in Georgian on 12 May 1982 page 2 carries Gruzinform correspondent N. Broladze's 800-word interview with R. Chikovani, director of Tbilisi's MION Scientific-Research Institute and its affiliated production plant, on the benefits such integrated facilities bring with regard to faster and more effective adoption of innovative designs and techniques. And he urges that the integration proceed even further, as in the case of MION, so that particular institute departments are in intimate liaison with plant shops and are responsible for overseeing organization of labor-cadre training, assimilation of new equipment and techniques. Research personnel thus acquire a better grasp of practical problems. A major factor hindering this kind of rapid functioning of the "science-to-production" chain is that innovations always require retooling and retraining, entailing loss of production time and consequent lowering of worker earnings. A more flexible approach to the system will correct that.

GEORGIAN SCIENCE CHAIRMAN DISCUSSES GOALS, INTEGRATION

[Editorial Report] Tbilisi KOMUNISTI in Georgian on 13 May 1982 pages 1-2 carries a 2200-word article by Irakli Gverdtsiteli, chairman of the State Committee for Science and Technology, on Georgia's current and long-term goals to make science a more effective and integrated component of economic development. The numerous factors in these endeavors include interdepartmental involvement in complex, goal-oriented projects, increased automation and mechanization, increased use of highly sophisticated computer and control systems, long-range program formulation and forecasting of scientific progress, and more efficient handling of information gathering, storage, and processing.

GEORGIAN ACADEMY'S ACCOMPLISHMENTS, GOALS

[Editorial Report] Tbilisi KOMUNISTI in Georgian on 14 May 1982 page 1 carries a 2800-word article by Evgeni Kharadze, president of the Georgian Academy of Sciences, on what the Academy has accomplished since it was founded and what goals it has set for the future, especially in line with the long-range program to the year 2005. Particular lines of research by different institutes are sketched, also projected new fields of science that will in the future require the establishment of their own separate institutes. Regarding cadre replenishment and training, Kharadze calls for ensuring that new personnel are provided with a healthy moral atmosphere and prompt rewards for good work. He emphasizes that institute directors must set an example of modesty; they must not arrogate all credit to themselves nor insist on "co-authorship" of published works. As to the graduate training program, the system by which it functions was established 50 years ago and no longer reflects today's realities and requirements. Among other measures Kharadze calls for reducing the number of graduate students admitted but imposing higher standards and raising stipends, which were left unchanged even after junior staff scientists' salaries were raised.

GEORGIAN REGIONAL RESEARCH INSTITUTIONS NEED UPGRADING

[Editorial Report] Tbilisi KOMUNISTI in Georgian on 14 April 1982 page 3 under the recurring rubric "Prior to the GCP CC Plenum" carries a 1200-word article by Docent G. Chubinidze, head of the Kutaisi Economic and Social Proglems Department under GSSR Gosplan's Scientific-Research Institute of Economics and Planning of the National Economy, concerning the need to upgrade the institute's various regional inter-rayon departments and make them better able to contribute to aspects of social and economic development within the general framework of the "Georgia--2000--Regions" program. The author sketches the work his own department has done for the area in and around Kutaisi since it was formed in 1973, and notes that despite the city's substantial role in the republic's economy (especially industry), Kutaisi has not a single independent sector institute.

Chubinidze proposes that the name and profile of certain of the republic's economic research institutes be modified to reflect advances and better promote scientific development. In particular, the Academy's Economics and Law Institute and his own parent (Gosplan) institute should be converted to "economic and social problems" institutes, as has been done in Moscow and Leningrad.

Finally, he notes that neither of Kutaisi's two major institutions of higher learning provide minimum candidate degree training, and urges "appropriate authorities" to rectify this matter.

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